Trimethylolpropane in Alkyds...p.29

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News about

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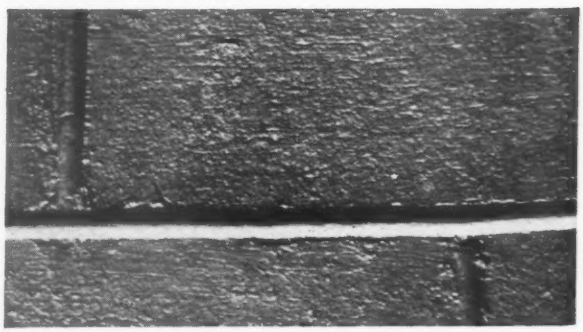
Closeups show how Geon vinyl paint produces...

on-the-surface results

Here are two of the test buildings that demonstrate the quality you get on the surface when Geon 450X3, a vinyl chloride-acrylic copolymer, is used for formulating outdoor paint formulations.

Both formulations—one for masonry, the other for wood—are based on the same Geon latex. On wood, notice that even under the metal meter housing there is no staining or dirt pickup. On masonry, after four years exposure the surface is considerably whiter than an oil-base paint after only one year.



advantages

- **simplified paint manufacture because binder is internally plasticized**
- **excellent stability and uniformity**
- **excellent adhesion to wood and masonry**
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- **tough, flexible tack-free films with outstanding pigment binding ability**
- **waterproof to exterior penetration, yet permits escape of interior moisture**

More test results and complete information on how you can profit from Geon in paint formulations is contained in a new booklet. Write for your copy. Dept. GP-3, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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PVP

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(REG. U.S. PATENT OFFICE)

APRIL 1960

Formerly PAINT and VARNISH PRODUCTION MANAGER
(Established in 1910 as The Paint and Varnish Record)

VOLUME 50
NO. 5

FEATURES

PRODUCTION

AEROSOL COATINGS

DEPARTMENTS

In Our 50th Year

NEXT ISSUE

Aerosol Coating Technology covering propellents, formulation, packaging, containers, and production will be featured in our May issue.

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EDITORIAL COMMENT

The Roy H. Kienle Award

IN RECOGNITION of the work and effort of deserving members of its various Technical Committees, the New York Society for Paint Technology established the "Roy H. Kienle Award" and made the first presentation at its April meeting.

It was particularly fitting that the first award was given to Dr. Roy H. Kienle, posthumously, whose work in the field of protective coatings is recognized the world over.

We are all aware of the fact that Dr. Kienle pioneered the field of alkyd resins. This work earned him the title of "Father of the Alkyds."

The discovery of alkyds contributed greatly to the transition of the paint industry from an art to a science and today alkyds are still the number one coating resin, despite the inroads made by new types of film formers.

Dr. Kienle was selected as the first Joseph J. Mattiello Lecturer, the highest honor bestowed by the Federation of Paint Societies. His lecture, "Physical Chemical Research in the Protective Coatings Industry" set a high standard which other Matiello Lecturers have maintained.

Despite his many activities, Dr. Kienle found time to engage in the work of the Technical Committee of the New York Society. This group often looked to Dr. Kienle for guidance and advice on problems encountered in the many studies undertaken by the various committees.

Over the past years, the findings of the Technical Committees of the various Societies have contributed much toward the technological progress of the paint industry. To gain an insight of the amount of work that Technical Committees perform, one has only to attend the annual meetings of the Federation. It is at these meetings that numerous papers based on technical studies undertaken by the committees are presented.

The New York Society is to be commended for establishing the "Roy Kienle Award" honoring those members who give much of their time and effort in the interest of paint progress.

Consumer Demands—Key to 1960

WHILE the consensus of opinion is that 1960 will show a record in economic growth, there are some uncertain features in the present business picture.

For example, the government's tight money policy is expected to result in a dip of 10 to 15 percent in housing starts this year from the 1959 level. Such a decline in housing is bound to be reflected in consumer demand for furniture and household appliances.

In the automotive field, the production of passenger cars has been moving at a fast clip during the first quarter of this year. However, purchases were anything but spectacular as dealers blamed bad weather as deterrent in retail sales. Many dealers are counting on the spring selling season to reduce accumulated stocks which had been built up to a near record of 925,000 cars at the end of February. It is interesting to note that the reception of new compact cars has been better than expected. Estimates are that the small cars are accounting for approximately one quarter of the total passenger car output compared with nine percent a year ago. While the compact unit is expected to take some business away from the standard size cars, total production of passenger cars is expected to reach a volume of 6.5 million during 1960.

A more recent development has been a drop in steel production with more declines anticipated in the weeks ahead. Cutbacks in the consumption of steel in automobiles, appliances, farm implements, and stamping operations is considered a factor in sagging demands for steel.

As the First National City Bank of New York aptly states in its March letter on business and economic conditions: —

"The key to the outlook for 1960 is in the strength of final demand by consumers, business and government. If demand is sluggish, production generally will decline. But if final demand as widely expected rises as the year goes along, the anticipated slackening inventory accumulation need not cause a business downturn."

PVP

Serving Administration and Technical-Production Management of Coatings Manufacturing Plants

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Buton Resins are suggested for use in primer formulations for appliances, automobiles and metals of all types. They can also be formulated for use in furniture finishes and in coating metal containers, cans, drums, etc. The unique properties of Buton Resins include excellent adhesion, high gloss and high chemical and abrasion resistance.

IN APPLIANCE PRIMERS

IN BUSINESS MACHINE COATINGS

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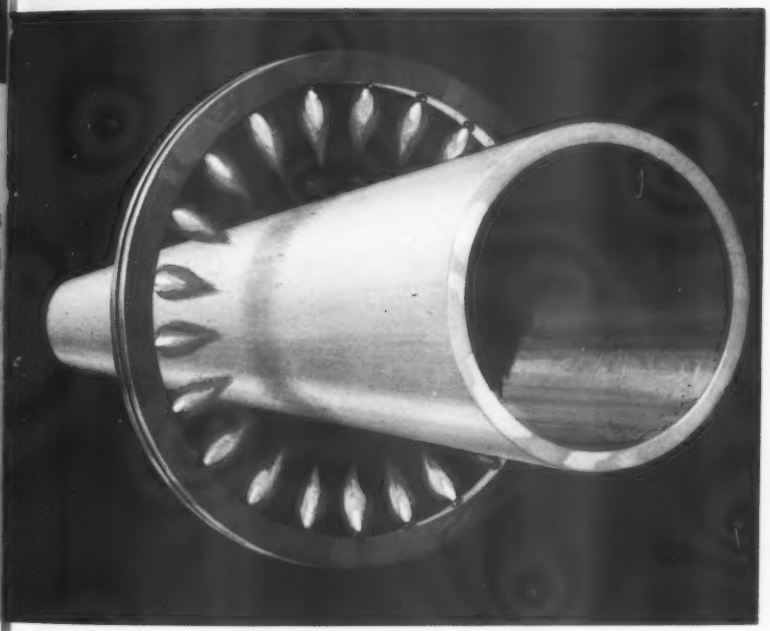

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BUTON RESINS PROVIDE THESE PROPERTIES:

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- Excellent Adhesion
- High Bulk
- High Compatibility
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- Good Electrical Resistance
- Good Pigment Wetting
- Tolerance For Inexpensive Solvents
- Lower Cost Than Other Quality Resins

COMPLETE TECHNICAL SERVICE AVAILABLE

Enjay offers you free technical assistance and guidance from one of the world's best staffed and equipped petrochemical laboratories. Here, Enjay scientists can help your surface coatings do a better job through efficient use of Buton Resins. For further information or to order, call or write the nearest Enjay office.

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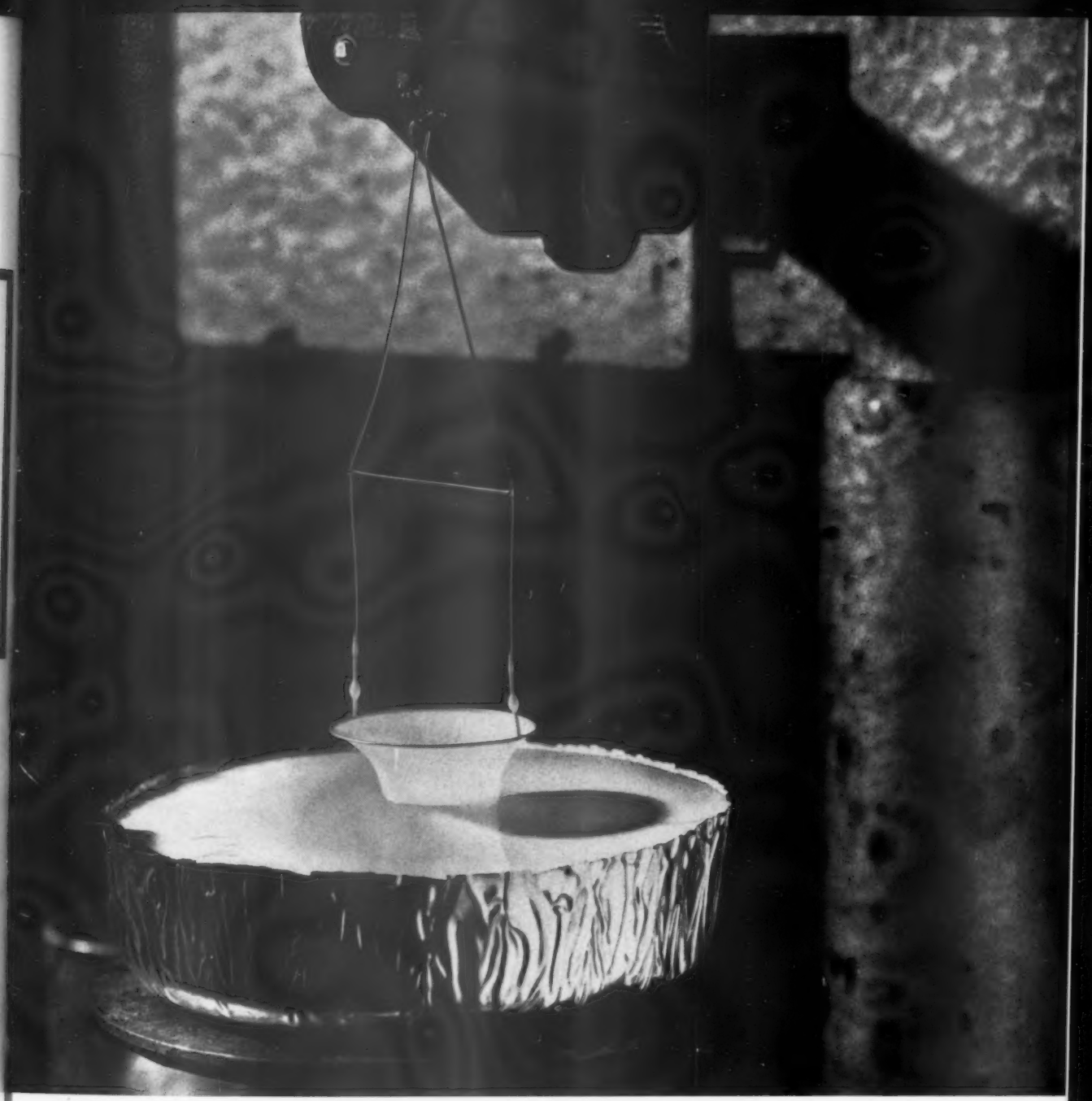

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Isano-based paint will blister under heat, forming a layer of insulating air that protects surface, retards charring.

Now a fire retardant paint can be made with a built-in intumescent vehicle. As shown above at right, Isano-based paint will blister when heat is applied, forming a layer of insulating air that protects the surface and retards charring. The same heat will cause ordinary paint film to burn, destroying the surface completely.

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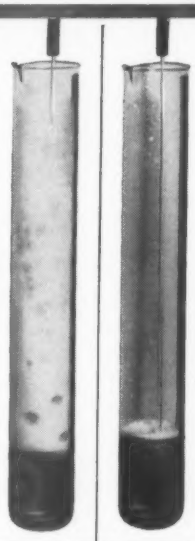
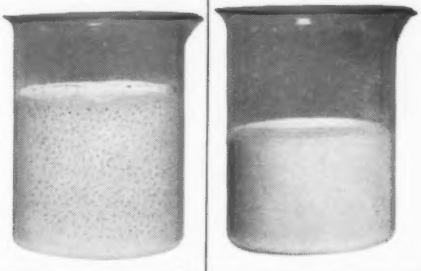
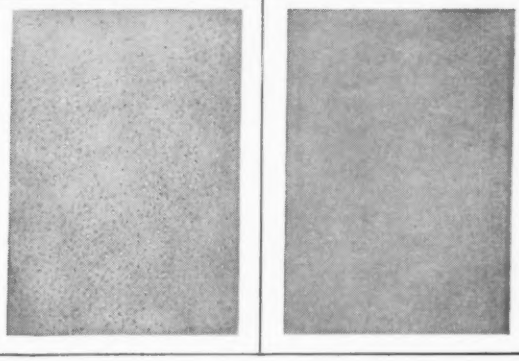


USE CSC's TRIBUTYL PHOSPHATE
the anti-foam agent extraordinary





CSC's Tributyl Phosphate—what an efficient anti-foam agent. See for yourself.

In each of the cylinders, air is being sparged through 20 ml. of detergent. The one at the left is quite a "headache". No such problem with the other cylinder because it contains Tributyl Phosphate (TBP)!

The beakers contain a typical latex emulsion paint. Weight in each is the same. But what a reduction in volume and foam in the one at right because it contains TBP!

The panels tell the same story. Each has been roller-coated with latex paint. But only the panel on the right contained TBP!

You can solve your foam problems, too, with TBP, CSC's outstanding anti-foam agent. Tributyl Phosphate is being used more and more not only in paints and detergents but also in the manufacture of paper, water adhesives, casein solutions, inks and sizings. Solve your foam problems with TBP. Write today for the full story on how TBP can help solve your foam difficulties.

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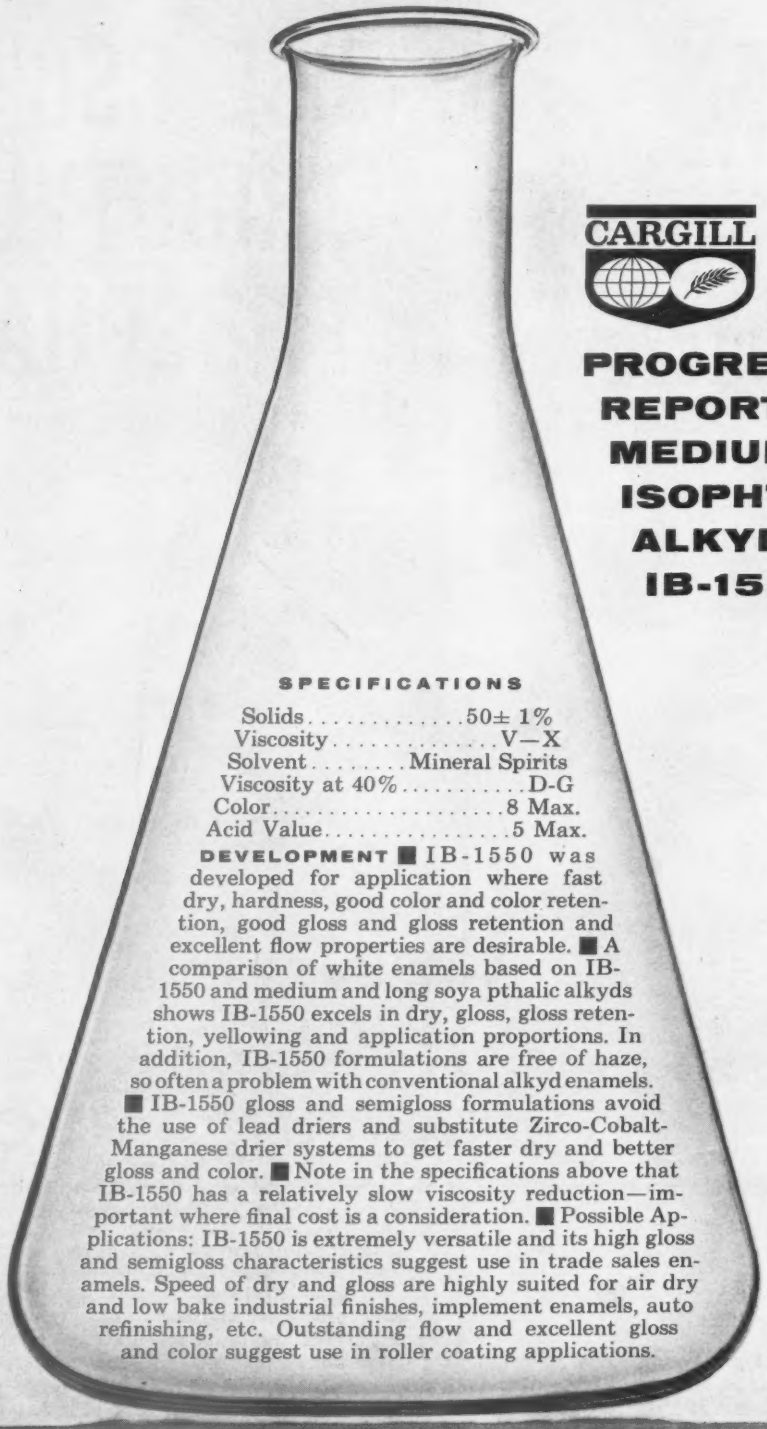

CARGILL

PROGRESS REPORT ON MEDIUM OIL ISOPHTHALIC ALKYD IB-1550

SPECIFICATIONS

Solids	50± 1%
Viscosity	V—X
Solvent	Mineral Spirits
Viscosity at 40%	D-G
Color	8 Max.
Acid Value	5 Max.

DEVELOPMENT ■ IB-1550 was developed for application where fast dry, hardness, good color and color retention, good gloss and gloss retention and excellent flow properties are desirable. ■ A comparison of white enamels based on IB-1550 and medium and long soya pthalic alkyds shows IB-1550 excels in dry, gloss, gloss retention, yellowing and application proportions. In addition, IB-1550 formulations are free of haze, so often a problem with conventional alkyd enamels. ■ IB-1550 gloss and semigloss formulations avoid the use of lead driers and substitute Zirco-Cobalt-Manganese drier systems to get faster dry and better gloss and color. ■ Note in the specifications above that IB-1550 has a relatively slow viscosity reduction—important where final cost is a consideration. ■ Possible Applications: IB-1550 is extremely versatile and its high gloss and semigloss characteristics suggest use in trade sales enamels. Speed of dry and gloss are highly suited for air dry and low bake industrial finishes, implement enamels, auto refinishing, etc. Outstanding flow and excellent gloss and color suggest use in roller coating applications.

Samples, formulations and test procedure reports on IB-1550 medium oil isophthalic alkyd are available by writing to Cargill.

CARGILL INCORPORATED

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Celanese CL-202 provides excellent tint retention at high PVC's

POLYVINYL ACETATE COPOLYMER EMULSION

You can use pigment volume concentrations of up to 45% with CL-202 and still achieve excellent tint retention. This finding is based on studies of painted wood and masonry exposed to weather over a period of five years. Test fences, test houses and field reports gathered throughout the country provided the evidence.

CL-202 paint films are non-yellowing and exhibit outstanding durability. Fine-particle size CL-202 emulsion gives your formulations greater stability and better quality. Our experienced technical staff will be glad to assist you in formulating exterior paints. For more information, simply write to:

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Export Sales: Amcel Co., Inc., And Pan Amcel Co., Inc., 180 Madison Ave., New York 16.

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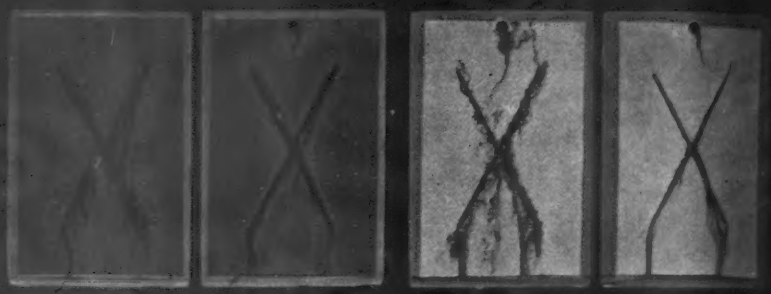
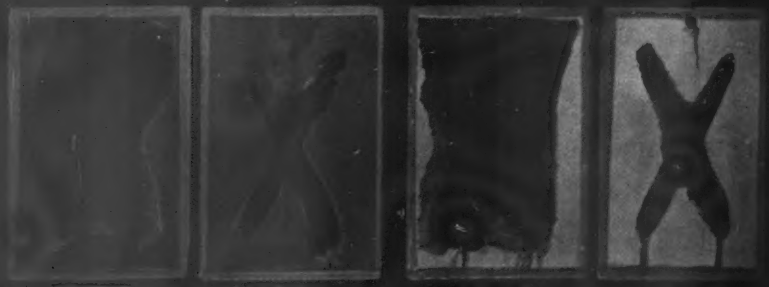


7528 7529 7518 7519

Test panels . . . after exposure



7528 7529 7518 7519

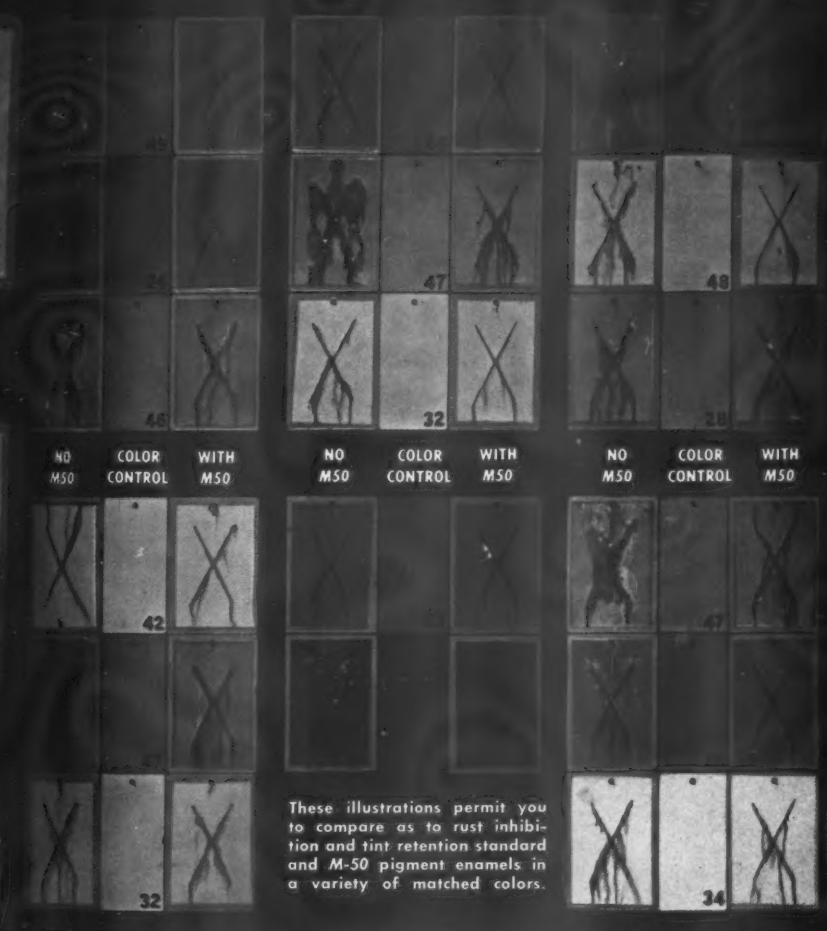
Duplicate test panels
. . . with loose paint removed

Salt fog test panels provide dramatic evidence!

Nothing **compares with *M50* pigment**

How tests were made — Test panels shown were scored and then exposed to 5% salt fog for 300 hours. Even-numbered panels were painted with standard industrial enamels. Odd-numbered panels were painted with color-matched, *M50*-pigment-fortified modifications made up with the same vehicles.

The four panels at the top permit you to compare appearance of the matched paints after exposure. The four panels at the bottom have loose paint removed so that you can compare the true extent of rust creepage under each paint film. Enamels were applied over clean, cold-rolled, auto body steel.



These illustrations permit you to compare as to rust inhibition and tint retention standard and *M-50* pigment enamels in a variety of matched colors.

. . for making a matched-color, one-coat

At National Lead Laboratories, One-Coat Metal Protective Enamels that match many colors currently used in such paints have been given comparative salt fog box tests. Here, spread out for your inspection, are a few examples.

As you can see, in each case, *M50** basic lead silico chromate pigment greatly increases the resistance of the enamel to under-the-film rust creepage. However, it should be understood and remembered... ***the more M50 pigment, the better the protection.***

As you can also see, the benefits of this powerful rust inhibitor can be incorporated without lessening the formulator's ability to match a wide

Tests shown at left were made in duplicate. The test groups right allow you to compare duplicate pairs in six typical groups. Notice that results are consistent.

enamel fortified with rust inhibitor

range of popular colors.

See for yourself!

If you make Metal Protective paints of *any* kind—or if you want to learn more about them...you should see for yourself how these paints perform with and without *M50* pigment. You are invited to visit National Lead's Sayville, L. I. Test Station. Here you can see and make your own evaluation of new paints for dozens of uses. Gain new knowledge, too, about the causes of metal protective failures and how to overcome them.

*Registered trademark of **National Lead Company**

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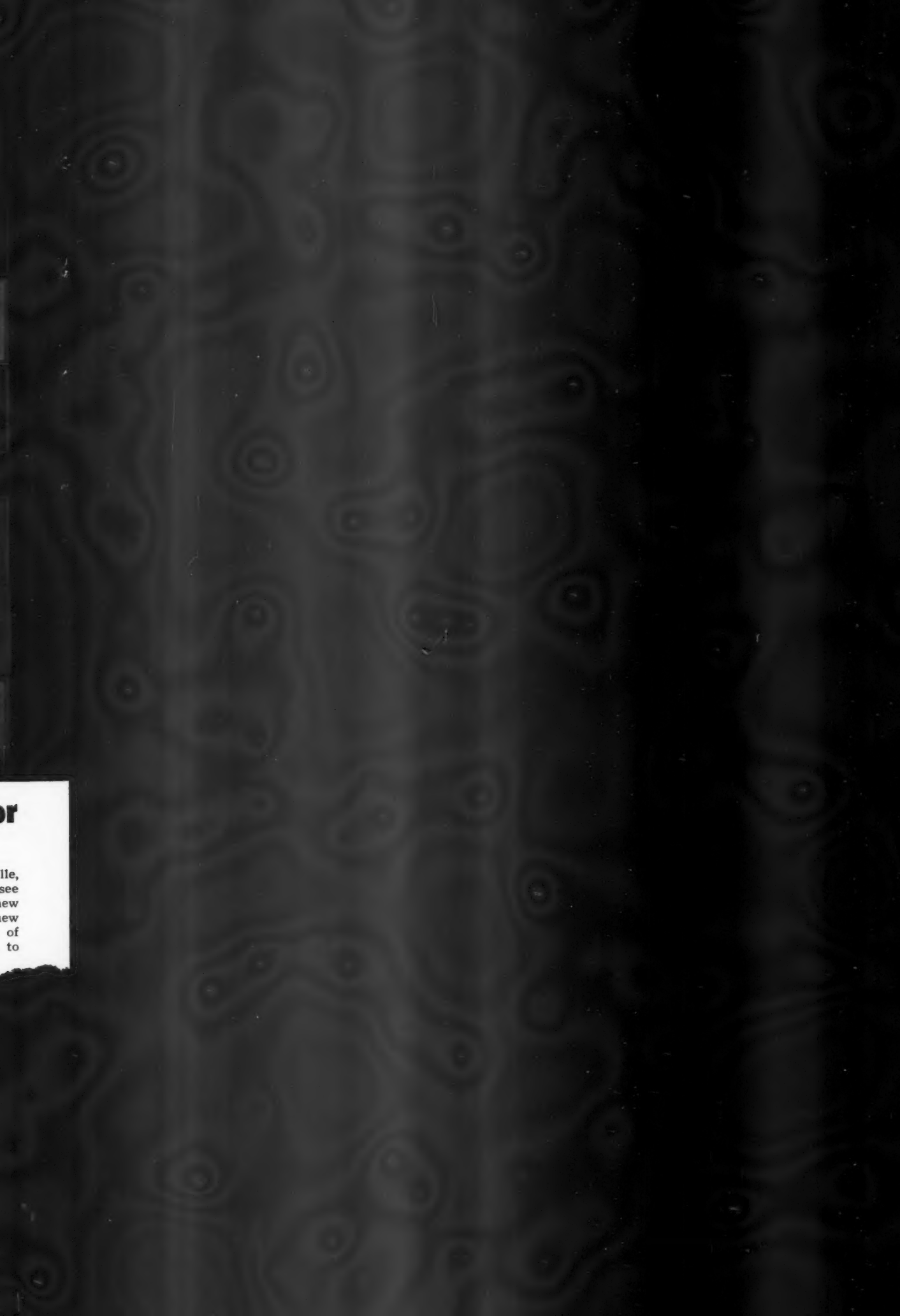


Formulae of YELLOW METAL PROTECTIVE PAINTS shown left

	(POUNDS per 100 gals) STANDARD PAINT (T-7518)	*M50* PAINT (T-7519)
Pigment		
M50® (basic lead silico chromate pigment)	—	150.0
Chrome yellow medium*	300.0	150.0
TITANOX® RA-NC (titanium pigment)	10.0	10.0
BENTONE® 38 (gelling agent)	3.0	3.0
	313.0	313.0
Vehicle		
Alkyd resin soln.**	570.0	570.0
Mineral spirits	119.0	109.8
Lead naphthenate (24%)	3.6	3.6
Cobalt naphthenate (6%)	1.4	1.4
Manganese naphthenate (6%)	1.4	1.4
Anti-skinning agent	1.0	1.0
Methyl alcohol – water (95 – 5%)	0.9	0.9
	697.3	683.1
TOTALS	1010.3	1001.1

PVC: 7518, 17.55; 7519, 20.4 Weight per gal: 7518, 10.1; 7519, 10.0 *Imperial X1810 or equal
**Fed. Spec. TT-R-266, Type III Prewet BENTONE 38 with methyl alcohol – water

Formulae of ORANGE METAL PROTECTIVE PAINTS shown left

	(POUNDS per 100 gals) STANDARD PAINT (T-7528)	*M50* PAINT (T-7529)
Pigment		
M50® (basic lead silico chromate pigment)	—	160.0
Molybdate orange*	120.0	80.0
Chrome yellow orange**	80.0	—
BENTONE® 38 (gelling agent)	3.0	3.0
	203.0	243.0
Vehicle		
Alkyd resin soln.***	570.0	570.0
Mineral spirits	134.7	118.8
Lead naphthenate (24%)	3.6	3.6
Cobalt naphthenate (6%)	1.4	1.4
Manganese naphthenate (6%)	1.4	1.4
Anti-skinning agent	1.0	1.0
Methyl alcohol – water (95 – 5%)	0.9	0.9
	713.0	697.1
TOTALS	916.0	940.1

PVC: 7528, 11.9; 7529, 17.6 Weight per gal: 7528, 9.16; 7529, 9.40 *Imperial X2552 or equal
**Imperial A4138 or equal ***Fed. Spec. TT-R-266, Type III
Prewet BENTONE 38 with methyl alcohol — water

. . for preventing rust creepage under One-Coat Metal Protective Enamels

These test panels show the amazing rust inhibition established by One-Coat Metal Protective Enamels made with *M50*® basic lead silico chromate pigment.

Notice that the use of *M50* pigment [illegible] retards both rust staining of paint [illegible] panels) and under-the-film rust creepage (bottom test panels). With *M50* pigment, damage to metal is restricted to immediate vicinity of break.

This same outstanding performance has been duplicated by *M50* Metal Protective Enamels in a wide range of other colors. For details lift flap.

Idealized conventional pigment particle

Solid

Idealized *M50* pigment particle

Coated

This diagram shows one reason why the *M50** particle is so efficient in the One-Coat Metal Protective Enamels described on preceding pages. As you can see, *all* the reactive content is surface-located . . . all available for the reactions which inhibit corrosion. None of the compound you want is buried *within* the particle where it would be useless. Another reason is that the reactive portion of the *M50* particle is a fused lead chromate. Fusion stabilizes the particle, and thus aids tint retention. The *M50* particle is also virtually insoluble in water.

It is these pigment properties that permit *M50* One-Coat Metal Protective Enamels and other *M50* Metal Protective Paints to be offered as superior-performance products.

* * *

The *M50* pigment particle has undergone more than twenty years of intensive pigment research including some eleven years of exposure testing and paint production.

The superior performance of these paints and variations of them is traceable to the use of *M50* pigment with its unique chemical compound and physical structure consisting of silico particles fusion-coated with active lead-chromium compound.

Other *M50* Metal Protective Paints

M50 pigment has become a standard rust inhibiting pigment widely used in a variety of anti-corrosion primers, intermediates and finishes for steel structures, in tank paints, and in many other metal protective applications. Typical formulations have been developed and tested for paints with a variety of uses. If you would like to know more about the use of *M50* in specific paints of this type, just let us know.

(MORE ABOUT *M50* ONE-COAT METAL PROTECTIVE ENAMELS ON PRECEDING PAGES)

*Registered trademark

M50 an oncor TRADEMARK *Pigment . . . A Development of*

National Lead Company

General Offices: 111 Broadway, New York 6, N.Y.

TRIMETHYLOLPROPANE and its use in ALKYD RESINS

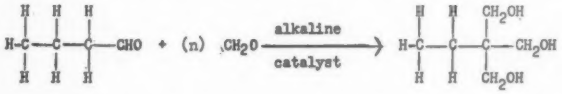
By

G. H. Weich* E. Bortnek**

J. A. Vona* E. J. Kuzma*

IN recent years many new materials have been introduced to the alkyd resin industry. Co-existant with this has been the heavy demand upon resin makers and paint manufacturers for paints having superior qualities at low prices. One of the more promising new starting materials is trimethylolpropane (2,2 dihydroxymethyl-1-butanol).

Trimethylolpropane is made by the reaction of butyraldehyde with formaldehyde in the presence of alkaline catalysts, as in the following equation:



Some of its interesting physical and chemical properties are shown in Table I.

Trimethylolpropane is useful in many fields of application including alkyd resins, urethane foams and coatings, synthetic lubricants, surface active agents and others. However, the data presented in this paper will deal only with the application of trimethylolpropane in the preparation of alkyd resins and the protective coatings formulated with these resins.

The complete evaluation of a new polyol is a highly involved and complicated procedure. Therefore, the procedures and formulations presented in this paper were not developed to answer any specific end use application, but to obtain general data for characterizing the use of trimethylolpropane in alkyd resins. Resin and paint formulators should consider this data only as a starting point in their evaluation. These formulations may be modified to meet specific end use requirements.

*Application Laboratory Product Development Dept., Celanese Chemical Co., Summit, N. J.
**Hostachem Corp., Empire State Building, New York 1, N. Y.

Part I
Short Oil Oxidizing Type Alkyd Resins

The trimethylolpropane short oil oxidizing type alkyd resin was prepared by the solvent technique in a five gallon electrically heated stainless steel kettle. The details of the preparation are given below while

TABLE I

Physical and Chemical Properties of Commerical Trimethylolpropane

Molecular Weight	134.17
Combining Weight	44.72
Hydroxyl Content, wt. %, min.	37.5
Melting Point Range, °C	57-59
Boiling Point 5 mm Hg A, °C	160
Flash Point, Cleveland Open Cup, °C	166
Fire Point, Cleveland Open Cup, °C	192
Bulk Density, pounds/cubic feet	
Free Flowing	35.5
Packed	38.4
Hydroscopicity	
Water Absorbed (weight %) in 68 hours	
at 27°C 18 - 26% R.H.	0%
25°C 29 - 33% R.H.	0.06%
27°C 70 - 80% R.H.	0.23%
Solubility Characteristics	
Water at 25°C	Very Soluble
Alcohols	Very Soluble
Acetone, 24°C	40 grams per 100 ml.
Ethyl Acetate, 24°C	8 grams per 100 ml.
Chlorinated Hydrocarbons	Insoluble
Aliphatic Hydrocarbons	Insoluble
Aromatic Hydrocarbons	Insoluble

TABLE II

Trimethylolpropane Short Oil Oxidizing Type Alkyd Resin

	Formulation (Parts by Weight) VII-192
Soybean Oil (Alkali Refined)	27.99
Trimethylolpropane (Celanese Chemical Company)	32.01
Phthalic Anhydride	40.00
% Excess Hydroxyl	32.5
Alcoholysis Time (Minutes)	35
Reaction Temperature (°C)	225/230
Reaction Time (Hours)	6.7
Acid Number (Solids)	9.4
60% Solution in Xylol	
Color, Gardner-Holdt	4½
Viscosity, Gardner-Holdt	Z3¾
50% Solution in Xylol	
Color, Gardner-Holdt	3½
Viscosity, Gardner-Holdt	V¼
Weight/Gallon (60% Solution)	8.3

*Viscosity increase after 3 years storage at room temperature: 1¼ Gardner-Holdt Units (V¼—W½).

the formulation and physical properties of a typical trimethylolpropane short oil alkyd resin are summarized in Table II.

Resin Cook Procedure

1. Soybean oil charged to kettle and heated to 200°C under N_2 blanket with good agitation.
2. The trimethylolpropane and litharge (alcholysis catalyst) were charged at 200°C and the temperature raised to 230°C. Reaction maintained at this temperature until alcoholysis was effected as indicated by the methanol dilution test.
3. Temperature reduced to 190°C and the phthalic anhydride plus xylol was added to the kettle. Temperature then increased to 230°C. N_2 blanket discontinued after steady reflux was reached.
4. Reaction temperature maintained at 225°/230°C to a viscosity and acid value end point.

Graph I depicts the rate of reduction in acid value with time at a reaction temperature of 225°/230°C and Graph II shows the rate of viscosity increase with time during the processing of the same alkyd resin.

White enamels were prepared from these alkyds by selecting a ratio of alkyd to melamine of 80/20. A base grind or paste was made initially which consisted of the following ingredients:

Materials	*Grams*
Titanium Dioxide (American Cyanamid OR-540)	1100.0
Trimethylolpropane Alkyd (60% Solution)	700.0
Soya Lecithin	2.0
Xylol	148.0
Butanol	50.0

Thereafter the required amounts of melamine, alkyd resin and xylol were added to give a pigment to vehicle solids ratio of 22/38 at a solids content of 60%. These enamels were then thinned with xylol until they were in a satisfactory spraying viscosity range (20-25 seconds, #4 Ford Cup). Table III shows this enamel formulation.

The enamel was sprayed on unprimed, cold rolled steel panels and baked according to a predetermined bake schedule, to give maximum hardness. This led to

TABLE III

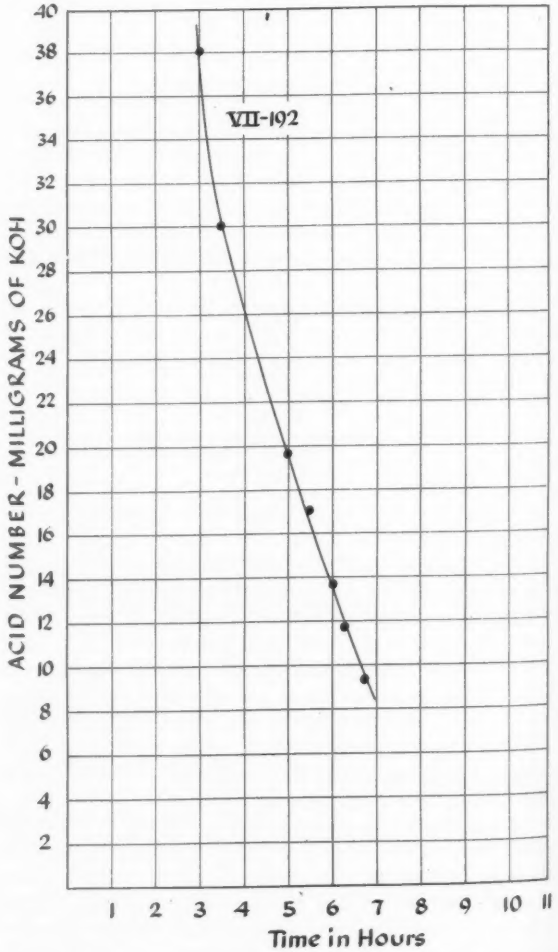
Enamel Formulation at Spraying Viscosity

Paint Formulation	**VIII-63A**
Alkyd Resin Formulation	**VII-192**
Formulation (Parts by Weight)	
Titanium Dioxide	19.14
Alkyd Resin (60% Solution)	44.02
Melmac 247-10	11.05
Xylol	24.85
Butanol	0.87
Soya Lecithin	0.0348
Anti-Skinning Agent	0.0435
Total Solids	52.26
Pigment/Resin (Solids)	22/38
Alkyd/Melamine (Solids)	80/20
Viscosity (#4 Ford Cup) Seconds	23

the observation that a rapid bake schedule could be obtained with the enamel prepared from this trimethylolpropane alkyd resin. The film properties as summarized in Table IV indicated that trimethylolpropane can be employed to advantage in the preparation of short oil oxidizing type alkyd resins.

The advantages obtained with trimethylolpropane in resin manufacture include:

GRAPH I

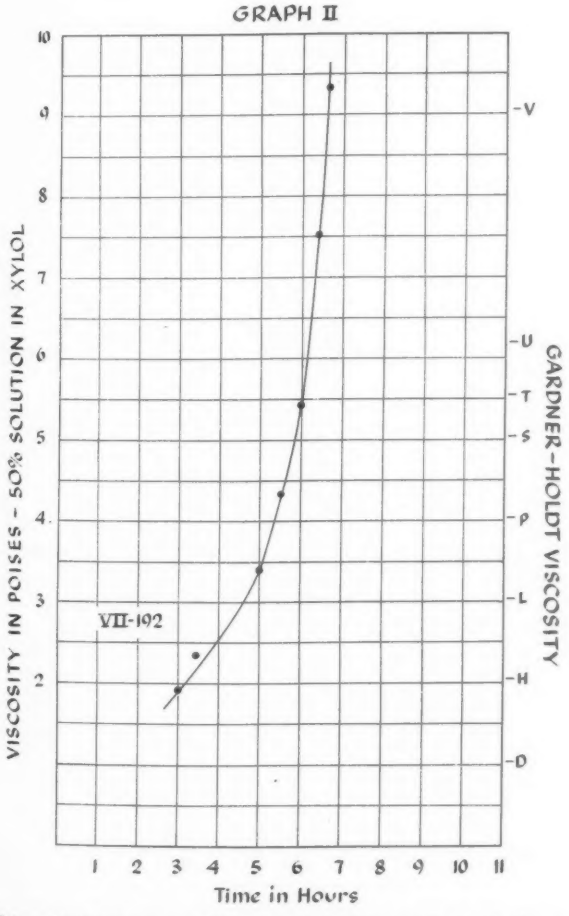


Trimethylolpropane Short Oil Oxidizing Alkyd Resin. Acid Value Reduction Versus Reaction Time.

(1) A short alcoholysis time can be achieved when trimethylolpropane is reacted with a drying oil. Several factors which contribute to this fast alcoholysis time are the presence of three primary hydroxyl groups and the low melting point of this polyol.
(2) Alkyd resins with light colors can be prepared with trimethylolpropane. One reason for the good color characteristics possible with trimethlolpropane is the spatial arrangement (neopentyl) of the functional groups on the molecule. This arrangement reduces possible side reactions which may produce compounds that contribute to color development.
(3) The alkyd resins produced with trimethylolpropane generally have a lower weight per gallon than the conventional type alkyds.
(4) The alkyd resins possessed excellent shelf stability after three years of storage at room temperature. The viscosity changes of the 50% solution in xylol of these alkyd resins are indicated in Table II.

The use of trimethylolpropane short oil oxidizing type alkyd resins in the formulation of paints offers the following advantages:
(1) Fast baking schedules.
(2) Hard Films.
(3) Excellent resistance to overbake (gloss and color).

GRAPH II



Trimethylolpropane Short Oil Oxidizing Alkyd Resin. Change of Viscosity Versus Time During Processing.

(4) Excellent color and color retention on aging.
(5) Excellent alkali resistance
(6) Good water and soap resistance

In addition, subsequent work has shown that trimethylolpropane alkyd resins afford excellent amine resin and solvent compatibilities.

Part II
Medium Oil Oxidizing Type Alkyd Resins

Trimethylolpropane offers the same advantages in the preparation of medium oil, oxidizing type alkyd resins as indicated in Part I of this paper. The cooking procedure is essentially the same as described in the previous section. Typical formulation data and processing conditions are given in Table V. The acid

TABLE IV
Evaluation of Enamel Film Properties

Paint Formulation		**VIII-63A**
Alkyd Resin Formulation		**VII-192**
Sward Hardness (Glass= 100)		43
Bake Time @ 300°F		20 minutes
Resistance to Overbake @ 300°F		
	(Gloss 60°)	86.0
1 Hour	(Color Yellowness Number)*	0.130
	(Gloss 60°)	78.0
8 Hours	(Color Yellowness Number)	0.203
Color Retention (Atmospheric)		
Initial	Yellowness Number	0.022
294 Days Exposed	Yellowness Number	0.017
294 Days Unexposed	Yellowness Number	0.034
Gloss Retention (Atmospheric)		
Initial		92
294 Days Exposed		88
294 Days Unexposed		90
Flexibility—Zuhr Conical Mandrel		No cracks, excellent film
Impact Resistance, Inch-Pound		Fail 6"
Rate of Abrasion, Loss in Weight, grams (500 cycles)		0.0550
Water Resistance, 15½ hours at 150°F		Good
5% Caustic Resistance at Room Temperature, 8 hrs.		Unaffected
Soap Resistance—15½ hours at 150°F		Good

*Measurement with Photovolt Corporation instrument

TABLE V

Trimethylolpropane Medium Oil Oxidizing Type Alkyd Resin

	Formulation (Parts by Weight) **VII-210**
Soybean Oil (Alkali Refined)	44.08
Trimethylolpropane (Celanese Chemical Company)	22.92
Phthalic Anhydride	33.00
% Excess Hydroxyl	15.00
Alcoholysis Time (Minutes)	30
Reaction Temperature, °C	245/250
Reaction Temperature, Hours	5.75
Acid Number (Solids)	9.1
60% Solution in Varsol #1*	
Color, Gardner-Holdt	5¼
Viscosity, Gardner-Holdt	Z5¼
50% Solution in Varsol #1*	
Color, Gardner-Holdt	4½
Viscosity, Gardner-Holdt	X-¾

*Esso Standard Oil Company

value reduction versus reaction time and viscosity increase versus reaction time are shown in Graphs III and IV.

Although medium oil length alkyd resins can be used for either baking or air drying systems, for purposes of this investigation, the enamel was evaluated only for its air dry properties.

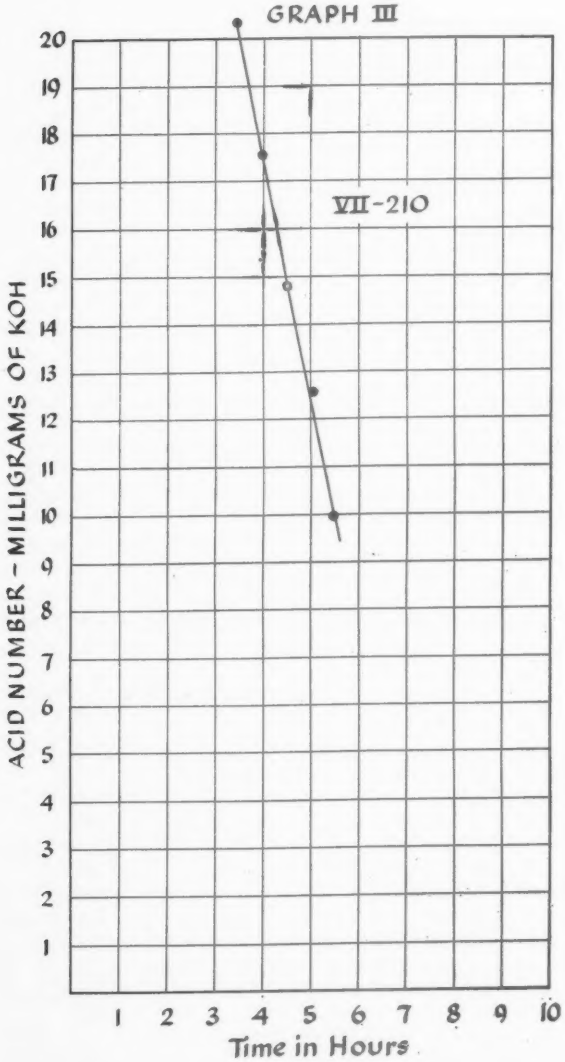
In preparing the semi-gloss enamels based on these alkyds, a base grind was first made which had the following composition:

Materials	*Grams*
Titanium Dioxide (American Cyanamid OR-540)	650.0
Alkyd Resin (50% Solution)	349.0
Soya Lecithin	1.0

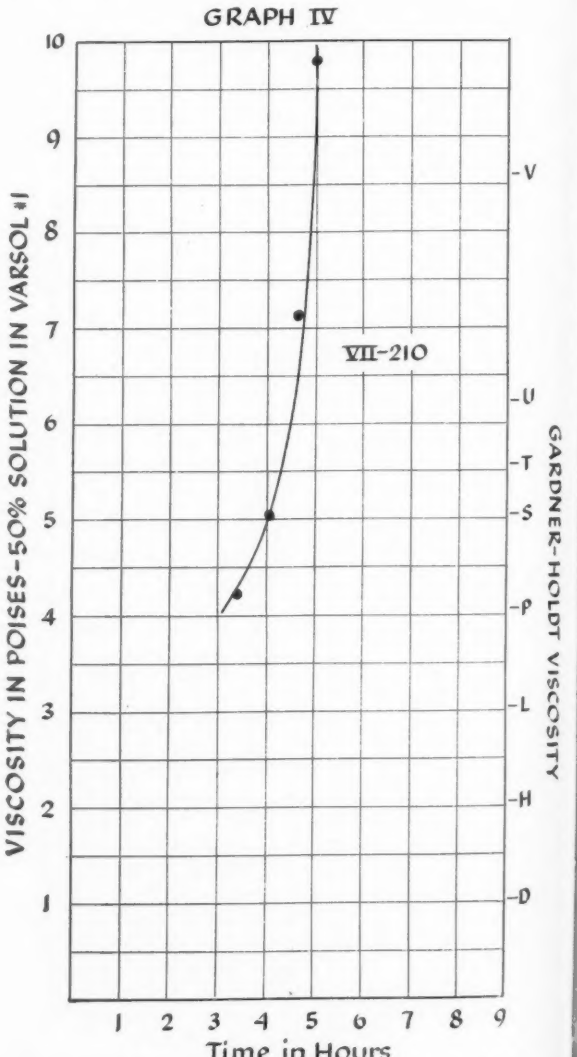
To this base grind were added alkyd resin solution, driers and Varsol #1 to give a pigment to vehicle solids ratio of 25/30 and a brushing viscosity of 80-90 seconds, #4 Ford Cup. To achieve a spraying viscosity, xylol was added to a viscosity of 24 seconds, #4 Ford Cup.

Table VI presents the raw material composition and physical constants of an enamel at brushing viscosity and Table VII shows this same enamel thinned down to a practical spraying viscosity. Enamel evaluations were carried out on films sprayed on unprimed, cold-rolled steel panels. The results of the enamel film evaluation (summarized in Table VIII) indicate that this trimethylolpropane medium oil oxidizing type alkyd contributed favorable properties to the enamel such as good dry time, and color retention on aging. In addition, the films also possessed good hardness with excellent flexibility, adhesion and impact resistance. The water and soap resistance of this enamel was outstanding.

Since these films can also be applied by brushing, it was determined that flow-out and brushing ease were excellent and no sagging was evident. These alkyds are primarily used for industrial application where an air dry enamel possessing good hardness and flexibility is required.



Trimethylolpropane Medium Oil Oxidizing Alkyd Resin. Acid Value Reduction Versus Reaction Time.



Trimethylolpropane Medium Oil Oxidizing Alkyd Resins. Change of Viscosity Versus Time During Processing.

TABLE VI

Enamel Formulation at Brushing Viscosity

	Formulation (Parts by Weight) VII-210
Titanium Dioxide (American Cyanamid OR-540)	25.03
Alkyd Resin (50% Solution)	59.44
Varsol #1 (Esso Standard Oil Company)	14.50
Soya Lecithin	0.0385
6% Cobalt Naphthenate	0.300
24% Lead Naphthenate	0.700
Total Solids	55.75
Pigment/Resin (Solids)	25/30.7
Weight/Gallon	9.28
Viscosity (#4 Ford Cup) (In Seconds)	87

TABLE VII

Enamel Formulation at Spraying Viscosity

	Formulation (Parts by Weight) VII-210
Titanium Dioxide (American Cyanamid OR-540)	23.23
Alkyd Resin (50% Solution)	55.16
Varsol #1 (Esso Standard Oil Company)	13.46
Xylol	7.19
Soya Lecithin	0.0357
6% Cobalt Naphthenate	0.0278
24% Lead Naphthenate	0.650
Total Solids	51.77
Pigment/Resin (Solids)	25/30.7
Viscosity (#4 Ford Cup) (In Seconds)	24

TABLE VIII

Enamel Film Evaluation (Medium Oil Oxidizing Type Alkyd Resin)

Set-to-Touch Time (Minutes)	25
Tack-Free Time (Hours/Minutes)	7/35
Sward Hardness (Glass..100)	
1 Day	15
3 Days	20
7 Days	19
17 Days	26
Water Resistance @ Room Temperature for 18½ hours	No Effect
Flexibility (Zuhr Conical Mandrel)	No Cracks
Impact Resistance (Inch-Pound)	>28"

Part III
Short Oil, Non-Drying Alkyd Resins

This section deals with the preparation of a short oil, non-drying alkyd resin based on trimethylolpropane and the enamel prepared from this resin. The alkyd resin was prepared by reacting coconut fatty acids and phthalic anhydride with trimethylolpropane in a solvent type cook. The procedure follows. Formulation, processing characteristics and physical constants are shown in Table IX.

Resin Cook Procedure

1. Charge the phthalic anhydride, trimethylolpropane and fatty acids to the resin kettle and sparge with nitrogen.
2. Esterify at 230°C using xylol as the azeotrope solvent.
3. Cook until the desired acid value and viscosity range is reached.

TABLE IX

Trimethylolpropane Short Oil Non-Oxidizing Alkyd Resin

	Formulation (Parts by Weight) VII-202
Coconut Fatty Acids	19.28
Trimethylolpropane (Celanese Chemical Company)	37.73
Phthalic Anhydride	43.00
% Excess Hydroxyl	25
Reaction Temperature, °C	230
Reaction Time (Hours)	7.35
Acid Number (Solids)	10.1
60% Solution in Xylol	
Color, Gardner-Holdt	3
Viscosity, Gardner-Holdt	Z5½
50% Solution in Xylol	
Color, Gardner-Holdt	2½
Viscosity, Gardner-Holdt	Z¾
Weight/Gallon	8.48

TABLE X

Enamel Formulation at Spraying Viscosity

Paint Formulation	**VIII-67B**
Alkyd Resin Formulation	**VII-202**
Titanium Dioxide	18.14
Alkyd (60% Solution)	41.73
Melmac 247-10	10.47
Xylene	23.13
Butanol	6.44
Soya Lecithin	0.0330
Anti-Skinning Agent ASA	0.0413
Total Solids	49.50
Pigment/Resin (Solids)	22/38
Alkyd/Melamine (Solids)	80/20
Viscosity (#4 Ford Cup) (Seconds)	24

4. Cool finished resin and dilute to 60% solids with xylol.

This trimethylolpropane alkyd resin was found generally to be compatible in all practical proportions with urea and melamine formaldehyde resins.

The preparation of the base grind and subsequent utilization of the paste in the enamel were carried out exactly as described in Part I of this paper. The enamel formulation at spraying viscosity is shown in Table X and a summary of the film evaluation is given in Table XI.

This enamel shows an unusual balance of film properties such as:

(1) Good hardness
(2) Good flexibility
(3) Excellent alkali resistance
(4) Excellent color and color retention on overbake
(5) Excellent water and soap resistance

Enamels with these characteristics should find wide application in such quality coatings as automotive topcoats and appliance finishes.

Summary

Trimethylolpropane is a unique polyol, imparting physical and chemical characteristics to alkyd systems which are far and beyond those which might be expected from its chemical structure. Such properties

(*Turn to page 103*)

SOME PERFORMANCES HAVE NEVER BEEN EQUALLED—

STANDARD FOR SKYSCRAPERS—Reaching majestically 102 stories and 1,250 feet into the sky, the Empire State Building is the world's tallest. In addition, a 222-foot television antenna towers above the building. Revolving searchlights installed on the 90th floor can be seen 300 miles away. More than 1,000,000 people visit the observation floor annually.

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Mineral Spirits	32
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Pine Chemicals Division, Naval Stores Department

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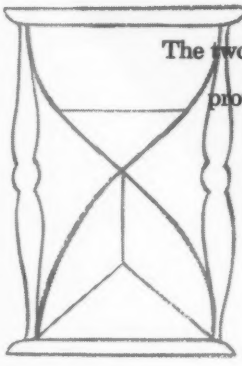

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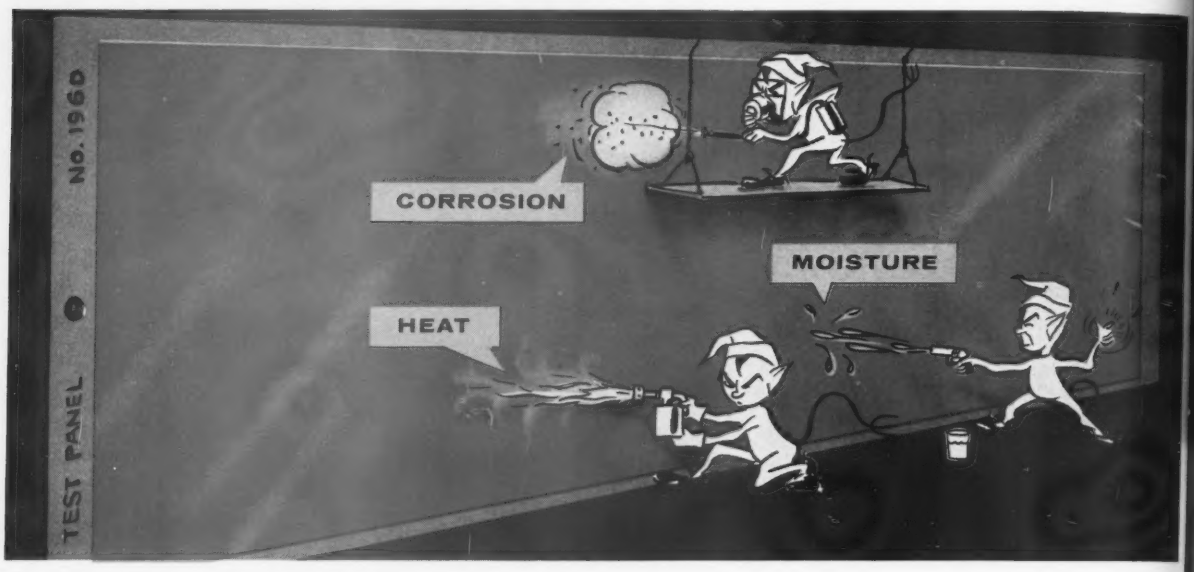
SILICONE NEWS from Dow Corning

A New "Resistance" Movement



Silicone Resin Based Coatings Resist Paint's Worst Enemies!

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804 Resin is a hard resin with excellent color and gloss retention and good heat stability at 400 F. Compatible with many organic resins, it is blended with them to improve resistance to both heat and water. Typical applications: coating impeller blades of jet aircraft; sealing electrical equipment; additive to basing cements for vacuum tubes.

805 Resin forms flexible film with good aluminum leafing properties and stability at 1000 F plus. Metallic paints made with 805 Resin are excellent for stacks, mufflers, boilers, jet engines, exhaust manifolds, heat exchangers, other high temperature equipment.

806A Resin is a hard, nonflexible material often blended with 805 Resin in aluminum formulations to increase toughness, improve drying properties. Makes colored enamels that have excellent hardness and adhesion at service temperatures to 450 F.

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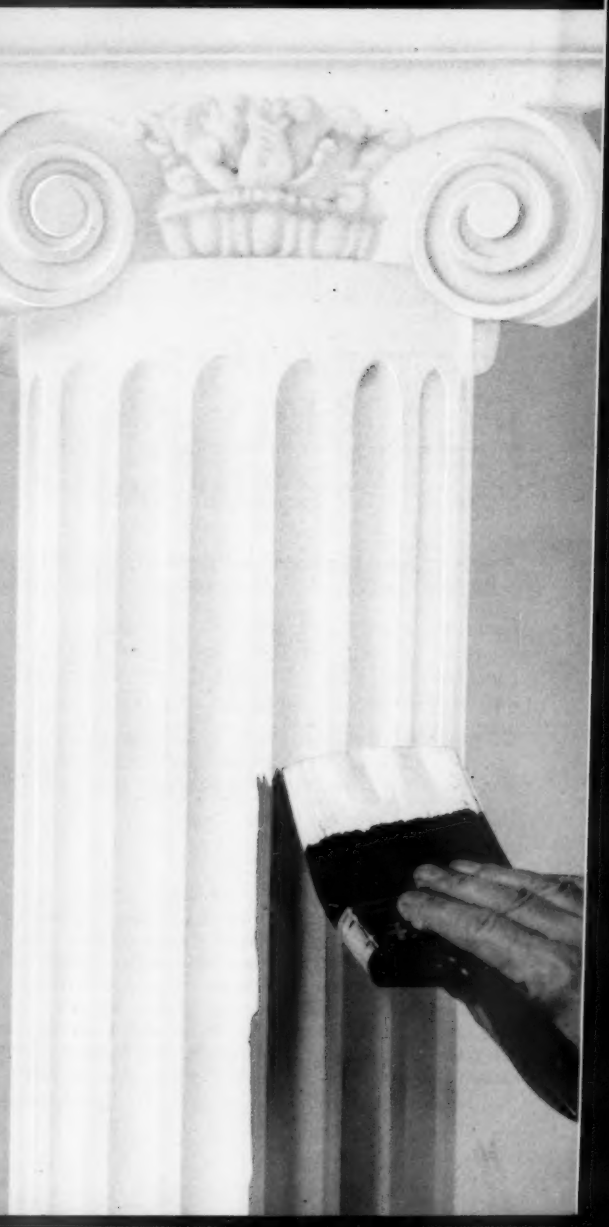

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Preparing

STABLE DISPERSIONS of OIL GELS

By
Dr. Max Kronstein*

ABSTRACT

Stable disperions were made from polymer oil solids in organic media containing some of the original monomer fluid oil in which the polymer solids are insoluble. In spite of the fact that the three dimensional structure of these solids implied strong intermolecular bonding or attractions, these forces between molecules were overcome, resulting in a very fine dispersion of the gel particles in the organic medium. This dispersion was obtained by heating the gel solids or their intermediate swelling products with metal-soaps which apparently relieve attractive forces between the molecules or particles and stabilize the particles from reaggregation or repolymerization in the suspension. The basic molecular structure of the dispersed gel matter is still apparently the same as it was before the gel had been dispersed. This is shown by a comparison of the diffraction x-ray spectra of the gel and of the dispersions, and by comparative chemical reactions such as oxidation tests, regellation tests and the production of specific solid products with monostyrene.

IN producing stable dispersions of solids in organic liquids the attractive forces to be considered are those between particles that produce instability. On the other hand, solvation works toward stability; and it has been brought out (Bender, M. "Introductory Theoretical Discussion to the Present Symposium" in preceding paper) that amphipatic molecular absorption and the electrical charges play a part in this dispersion. In the present paper the solids to be dispersed are apparent by three dimensional polymer solids which are insoluble in organic fluids, but by the reaction with metal-soap products it is possible to counteract the strong attractive forces in the solids and to produce stable dispersions. It can be assumed that this stability is maintained through the amphipatic nature of the metal-soap and of molecules in the liquid medium. It is very well possible that electrical charges originate from the metallic cations in the metal-soap resulting in solvation.

Experimental

Preparation of Oil Gels and Dispersion

The oils which were used were (a) polyhydroxyl alcohol fatty acid esters, based on alcohols having at least three hydroxyl groups and either being capable of polymerization due to existing unsaturated groupings in the acid part or capable of forming new double-bonds under suitable treatment, followed by subsequent polymerization; and (b) the wax type higher fatty acid esters of high molecular polyhydroxyl alcohols having less than three hydroxyl groups. These oils are soluble, fusible or fluid when they are in a state in which they can be molecularly dispersed in a suitable solvent. Such solutions maintain their viscosity at a given temperature within the temperature range suitable for the solvent used in the solution.

By ordinary heating or by heating during aeration or by the release of organo peroxides these soluble oils can be transformed into three dimensional, non-fusible, gelation products. The fact that the semi-drying or non-drying oils can be transformed into these gelation products when subjected to vacuum distillation was shown some forty years ago (Kronstein, A., Ber., (1916) pages 722-732). In this case, the gels differed only in the amount of fluid matter which distilled off before gelation occurred. The fact that all the oils can be gelled and solidified by the action of peroxides was shown by this author eight years ago (Kronstein, M., U. S. Patent 2,-599,397 (June 3, 1952)). Some examples are shown in Table 1.

The gelation products of the oils appear as coherent gels which are insoluble, swelling matter containing three dimensional units swollen with still-soluble oil substance; or they appear as "solids", which is a three dimensional substance and is incoherent, insoluble, limited swelling and capable of being freed of the soluble phase by solvent extraction. The two phases can be studied in the infrared spectrum of the gelation products. The liquid oils have a deep band between 8.5 and 9.5

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TABLE 1.
SOME EXAMPLES OF SOLIDIFICATION WITH PEROXIDES

Oil Used	Oxygen-Yielding Catalyst	Volatile Added
I. Natural Fixed Oils:		
a) 100 Parts Florida Tung Oil	7.5 parts d-Tert.-Butyl-Peroxide.	—
b) 66.6 Parts Linseed Oil 33.4 parts Tung Oil	9.9 parts t-Butyl Perbenzoate.	—
c) 100 Parts Bodied Linseed Oil (Z-2)	8.8 parts 95% Benzoyl Peroxide with Stearic Acid.	—
II. Synthetic Fixed Oils:		
a) 100 Parts Isomerized Linseed Oil (Isoline).	8.3 parts Diacetyl Peroxide.	16.6 parts Dimethyl-Phthalate.
b) 100 Parts Dehydrated Castor Oil.	9.6 parts Di-Tert-Butyl-Di-Perphthalate.	4.8 parts Petrol-Naphtha.
III. Wax Type Esters:		
a) 100 Parts Shellac Wax.	3 x 12 parts t-Butyl-Perbenzoate.	—
b) 100 Parts Spermacetti Wax.	3 Treatments with Decreasing Amounts of t-Butyl-Perbenzoate (4 and 3 and 2.5 Parts).	

From U. S. Pat. 2,599,397.

TABLE 2.
REACTING DIFFERENT KINDS OF OIL WITH PEROXIDE TO SOLIDIFICATION

Type of Oil	Parts Peroxide To 100 Parts Oil	Peroxide Releases To Solification
Drying Oil With Conjugated Double Bonds: (China Wood Oil)	8	1
Drying Oil Without Conjugated Double Bonds: Linseed Oil (with 5 parts Toluene)	10	1
Bodied Linseed Oil	8.8	1
Non Drying Oil:		
Cottonseed Oil (with 5 parts Toluene)	10 plus 7	2
Same, After Removal of 19% Liquid Matter		
By Vacuum Distillation	5.7	1
Cornoil	9 plus 5	2
Mixture of a Non Drying Oil With a Drying Oil Having Conjugated Double Bonds:		
82 Parts Cornoil and 18 Parts Tung Oil	12	1
Non Drying Animal Oil:		
Menhaden Fish Oil (with 5 parts Toluene)	10 plus 7.5	2

microns and they have a lesser band at 10.3 microns. In the Nujol mull of the incoherent solid linseed oil, the deep band at 8.5-9.5 microns has completely disappeared and the 10.3 micron band has decreased to some minor extent. The gel spectrum shows the same pattern of the spectrum between 9.5 and 11 microns as the three dimensional solids; but it still show up to some extent between 8.5 and 9.5 microns the pattern of the soluble oil, which is present as sweller in the gel.

In heating oils with organo peroxides and by increasing the temperature slowly and by releasing the peroxide gradually, the oils might turn into the coherent form of the gel. By releasing the same amount of peroxide instantaneously the non-coherent, solid form of the oil can be obtained. In this case a considerable amount of heat is evolved.

The semi-drying and non-drying oils and the wax esters might require more than one treatment with peroxide to produce one of the two forms of gelation, as shown in Table 2. The infrared spectrum of these products shows that the first treatment can considerably increase the band at 10.3 microns and that this band decreases again with subsequent treatments. Similar new band formation has been observed in the spectra of the oils after exposure to Cobalt 60.

In producing stable dispersions of the gelation matter, these fluid substances are in the first line to be used as the liquid media in which to prepare the dispersion; but combinations can be used also between such oils and solvents and resinous compounds, which are soluble in the liquid phase used in the preparation of the dispersion.

The dispersions have been obtained by heating the gel matter with metal-soap compounds until melting occurs. When the coherent gel matter is dispersed in a melted metal-soap compound, additional liquid substance might not be required to produce this form of "melting" into a dispersion. If the gelation substance is low in content of the fluid phase or if the metal-soap compound is in a highly concentrated form, it might be necessary to add additional fluid matter, such as described under "B", in order to obtain the stable dispersion. When the outside of the gel has undergone progressing oxidation, earlier, some of the oxidized matter might remain like a skin in the melt, indicating that the metal-soap dispersion effect decreases with the progressive oxidation of the gel.

After the gel has "melted," the mixture between the gel substance and the metal-soap carrying matter can be mixed further with additional fluid oils, or with melts of resins or asphalts, and can be taken up in suitable organic solvents such as coaltar solvents, petroleum solvents and their mixtures. Clear dispersions are obtained which can be filtered like solutions, and which are capable of film formation. Recent control tests on some dispersions which had been stored in a closed container for about ten years show that the dispersions remain stable over such a period of time.

The metal-soap compounds can be produced by heating fluid oils (drying, non-drying, vegetable, animal or synthetic) with metal-salts until a reaction has taken place between the metal salt and the oils. Increased viscosity is accompanied by heating. To give a few examples of these products, 93 parts linseed oil or cottonseed oil or codliver oil or polyethylene glycol di-tri-ricinoleate were reacted with 1.5 to 5 parts cobalt acetate, lead acetate, cobaltous nitrate or other metalsalts.

Instead of preparing these metalsoap compounds from oils, they have been prepared from fatty acids, rosin acids, petroleum acids and from wax-like esters. (Kronstein, M., U. S. Patent 2,476,879 (July 19, 1949) and U. S. Patent 2,568,550 (September 18, 1951)). To disperse 20 parts of gelation products or solids, 5 to 10 parts of the metal-soap compounds have been added, as shown in Table 3. Thus, it is possible to disperse or to "liquify" the gelation products of one kind of oil with the metal-

soap compounds derived from another oil or the various formed metal soaps.

Properties of the Dispersions

After the dispersion has been obtained, it remains stable in any form which it might be used. For instance, the dispersion of the gelation product in the metal-soap compound can be reduced in viscosity by the addition of fluid matter immediately, or it can be stored for days and weeks and can be further reduced in viscosity by the addition of more of the liquid phase substance with or without the application of heat. The dispersion can be modified further by melting it with resins and asphalts at the time when the dispersion has been produced, or it can be done at a later time.

The dispersion in a diluted form remains stable, and additional solvents or diluents can be added as long as the fluid which is used has suitable properties which will induce swelling but the gel matter can still be precipiated from the dispersion when some amounts of poor swellers or diluents are being added, such as ether petroleum. This is one of the characteristics which shows that the chemical nature of the original gel or solids has not been changed during the preparation of the dispersion.

There are other methods of studying the dispersions and further modifying the gel matter in the dispersion. A fluid oil or a film produced from a fluid oil without the use of catalytic polymerization agents shows in its x-ray diffraction spectrum no specific peak formation at an instrument angle of between 30 and 15 degrees. All of the oil gelation products showed a peak in this area, with the peak at an instrument angle of between 19 and 20.3 degrees. The calculated Angstrom spacing of a considerable number of different preparations of gelled and solid matter from oils and from alkyd resins varied to a small extent only, between 4.37 and 4.65 Angstroms. A film produced from a commercial methyl cellulose gave the same kind of peak in the same area with a spacing between 4.18 and 4.5 Angstroms. Figure 1 shows that in dispersing a soybean oil gel with a metal-soap the gel peak and the Angstrom spacing in the peak is retained, varying between 4.67 and 4.46 Angstroms, and only the width of the peak and its slope have been widened due to the dispersion or "liquifaction" of the gel.

The infrared studies of the monomer and the gelled and the solid gelation products of the oils have shown that not all the unsaturation bands of the monomer disappear in the formation of the three dimensional matter, which means that this matter is still reactive.

TABLE 3.
SOME EXAMPLES OF THE RE-DISPERSION OF OIL-GELS

Gelatinized Oil:	Contact Substance:	Obtained From Reacting:
(a) 20 Parts Linseed Oil Gel	5 Parts	93 Parts Linseed Oil With 1.5 Parts Cobalt Acetate
(b) 20 Parts Linseed Oil Gel	6 Parts	93 Parts Linoleic Acid With 2.8 Parts Manganese Acetate
(c) 20 Parts Linseed Oil "Solids"	10 Parts	93 Parts Linseed Oil With 8.1 Parts Chromium Carbonate
(d) 20 Parts Codliver Oil Gel	10 Parts	93 Parts Linseed Oil With 1.5 Parts Cobalt Acetate
(e) 20 Parts Soybean Oil Gel	5 Parts	31 Parts Polyethylene Glycol Di-Tri-Ricinoleate With 5 Parts Cobalt Acetate

Ref: U. S. Pat. 2,476,879 and 2,568,550

If the oil has been solidified rapidly by peroxide treatment there is only a small change in the carbon and hydrogen content of the oil and in the calculated oxygen content. This is shown in Table 4. If the oil has been gelled slowly by heat treatment with aeration, the oxygen content increases considerably. The rapidly produced solids can be oxidized further by exposing the oil solids to air at 100°C. without other catalytic treatment. This means that the oil gelation products are capable of further oxidation. They are capable of additional chemical reaction with other chemical groups such as with vinyl tri-chlorosilane or with di-allyl sulfide or allyl mercaptan, forming chemical reaction products. The silicone or sulphur content in the reaction products have been analyzed and reported in an earlier paper by this author. (Kronstein, M., "Investigation of Catalytic Solidification", in Third Symposium of Varnish and Paint Chemistry, New York University, College of Engineering (1950) Tables II, III, IV).

The chemical reactivity of the gelation product is still present in the dispersion. That is why the film forming characteristics of the dispersion have been followed by additional surface oxidation or curing of the film. This has been measured by determing the increasing strength of the coherence in the resulting film when such a dispersion has been applied on a surface with fine wire ends imbedded in the film. By pulling the wires with a calibrated spring balance at certain time intervals during heat exposure of the film at 120°C., the spring stretch which was required for the removal of the test wires increased in a linear manner during 100 minutes curing time.

The coherence of the cured films was

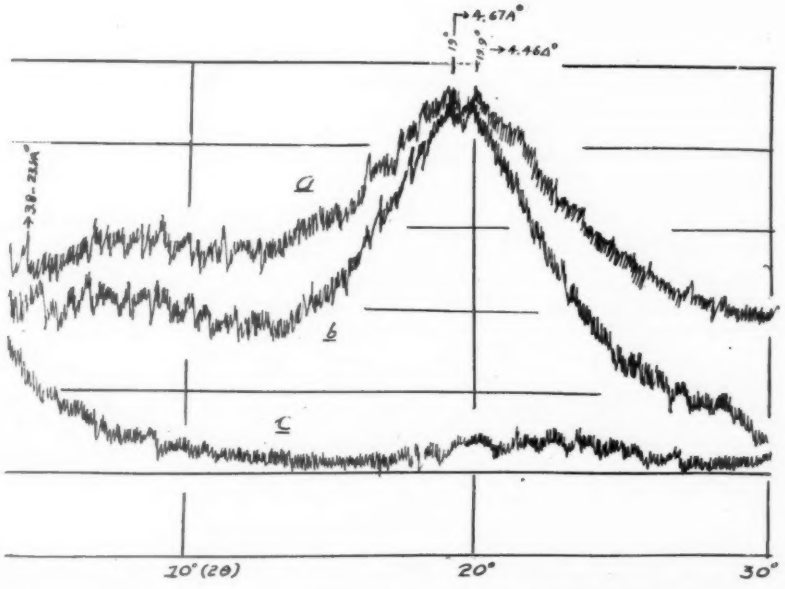


Figure 1. Change in the X-ray diffraction spectrum during the redispersion of the soybean gel. (a) the resolubilized soybean gel without solvent, (b) same soybean gel without solvent, (c) film of the initial soybean on glass slide (heated 10 days at 100 deg. C.).

tested also by applying them on copper panels in a dry film thickness of 2.7 mils, exposing them further to heat at 125°C. for 456 hours, and then bending them on a one-eighth inch mandrel and straightening them out again. No cracks in the film were observed in this test. In dielectrical tests no breakdown occurred before 4800 Volts (1771 Volt per mil) in Test I and 6900 Volts (2550 Volt per mil) in Test II. These data show that the dispersion produces films of a very high degree of coherence.

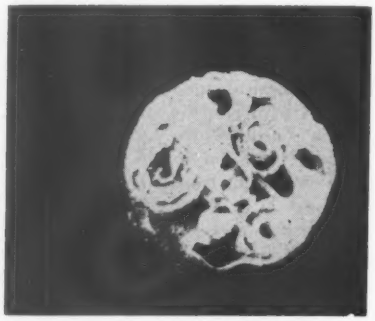
The fact that these films contain the dispersed gel matter in its reactive form has been established by contact of the material with monostyrene. The observation was made some time ago that the immersion of a small amount of insoluble, incoherent "popcorn" styrene in freshly distilled monostyrene, at a temperature of 50°C., causes the formation, of the growth, of an incoherent, insoluble polystyrene from the fluid monostyrene. By immersing the three-dimensional linseed oil solids in the same manner in the freshly distilled monostyrene, the same kind of incoherent, insoluble, non fusible polystyrene can be obtained. This formation "grows" to a higher level in the test tube than the monostyrene.

By dispersing the three dimensional gelation products of the oil in the described manner and forming a film from this dispersion, it was expected that the film would contain the three dimensional units throughout the film in some kind of a fixed position, and that by immersing such a film in freshly distilled monostyrene, the growth would start from the various dispersed centers. This was the fact, indeed, and the styrene formed film-like products throughout its own volume. One of these formations is shown in Figures 2 and 3. This "grown" styrene had a similar x-ray diffraction spectrum as the dispersion film which had been used for the immersion test. The spectra are shown in Figure 4. This test group again shows that the dispersed matter is still of a similar chemical character as before the dispersion was made.

TABLE 4.
ANALYTICAL COMPARISON OF LINSEED OIL IN DIFFERENT STATES
(EACH AVERAGE FROM TWO TESTS)

	Theoret. Mixed Triglyceride (Calc.)	Bodied Linseed Oil Z-2	Slowly Heat-Gelatinized Linseed Oil (Isolated Toluene Purified Product)*	Catalyt. Solidified Linseed Oil (Dried Over H_2SO_4)	Same After 66 Hrs. At 100 C.
% H (Found)	10.90	11.085	9.235	10.48	9.86
% C (Found)	77.96	77.70	68.48	76.78	72.435
% O (Calc.)	11.14	11.215	22.285	12.74	17.705

*Isolated substance from a slow heat gelatinized product obtained from a bodied linseed oil Z-2 in 15 lbs. batch. Isolated by extraction in boiling toluene. % insoluble substance found in different tests varied between 34.22% and 46.26%.



Left (figure 2): Side view of product formed when re-dispersed linseed oil gel is reacted with freshly distilled monostyrene. Right (figure 3): End view of the same product shown in figure 2.

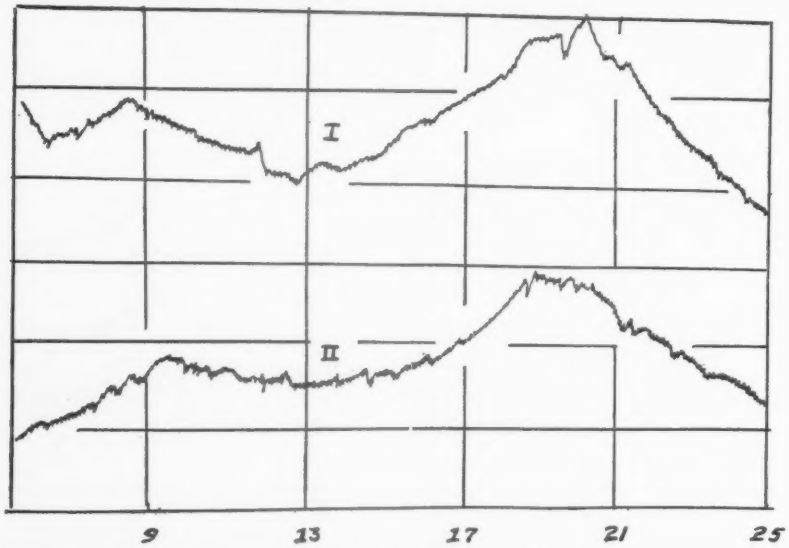
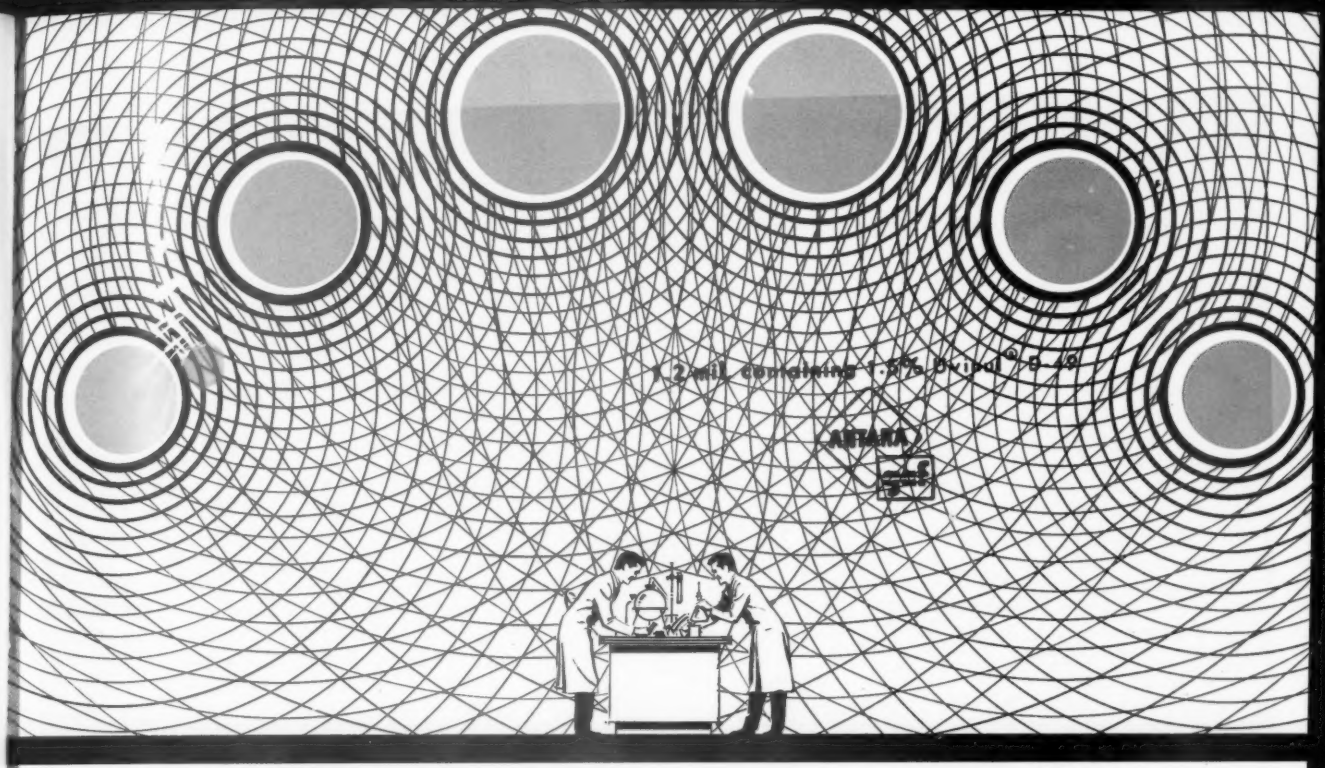


Figure 4. Diffraction X-ray Spectra
I. Free film form re-dispersed linseed oil gel
II. Grown styrene "leaf" using film as seed.

Discussion

In the stable dispersions which have been described it might be assumed that the gel linkages must be overcome in order to make the dispersion possible. These linkages might be chemical or of van der Waals' nature. The dispersion does not require a change in the chemical properties of the gel substance, since many of the characteristics of the gel have been retained in the dispersion. That this dispersion occurs from the effect of a metal soap must be the result of the metalsoap as a soap, since it is not limited to the metalsoap derived from any particular metal. It requires that the metalsalts are first transformed into metalsoaps, because the salts alone have no dispersing effect on the gels. Therefore the amphipatic characteristics of the soap are important in producing the dispersion. Although the mechanism is unknown, it seems likely that solvation, especially from the similarity of the monomeric molecules in the medium and electrical charges originating with the metalsoaps are factors also in bringing about the extreme stability of the dispersion which has been observed in spite of strong bonds holding the original gel together.

This paper was presented at the Joint Symposium of the American Chemical Society Division of Colloid Chemistry and of Paint, Plastics and Printing Ink Chemistry, at the 134th National meeting in Chicago, Ill.



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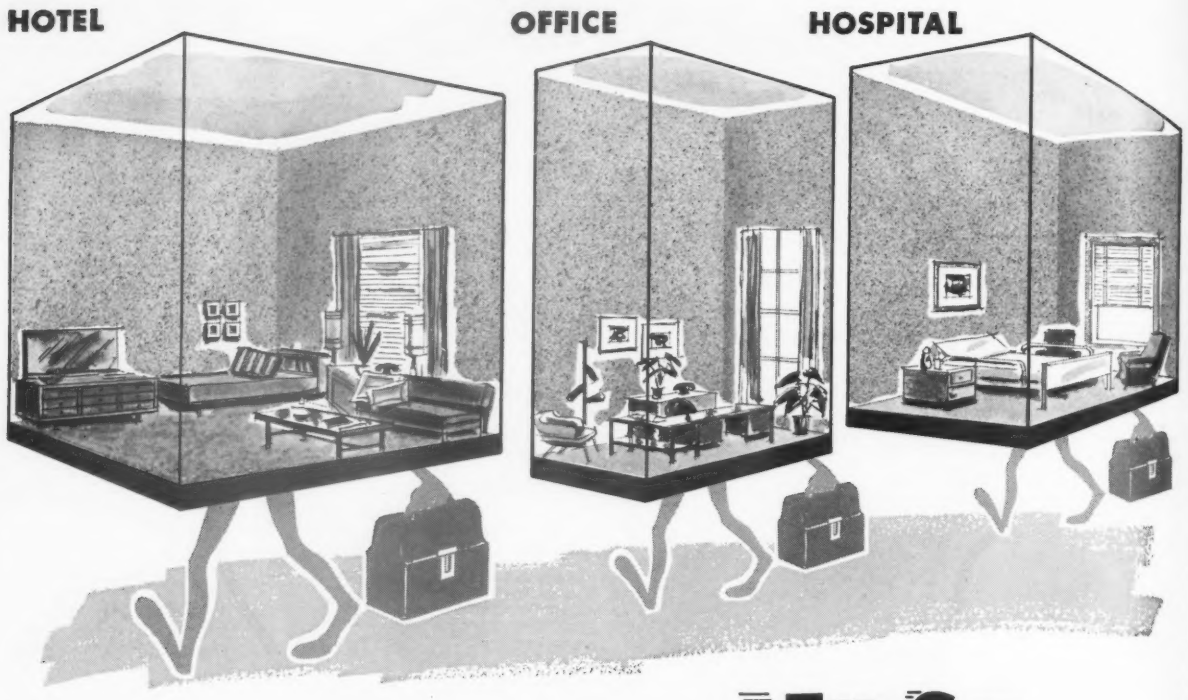

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By
Thomas H. Ferrigno*

Part II

Preparation of Paints of Specific Excess Binder Content

White Paints, 50% Excess Binder:

Paints were formulated by applying the data obtained from Figure No. 1 (see Part I, March issue) and calculated in the usual manner. The formulas derived and characteristics of the paints are reported in Table VI. The paints were very viscous, therefore an additional quantity of mineral spirits was added to each to obtain brushability.

White Paints, 109% Excess Binder

The formulations were calculated from the data obtained from Figure No. 1, and as before were based upon 73.69 gallons non-volatile volume per 100 gallons of paint. The magnesium silicate again produced a highly viscous paint and the addition of mineral spirits to obtain brushability was necessary. The above formulations and paint characteristics are reported in Table VII.

Red Paints, 100% Excess Binder

The paints were formulated from the graphs of Figure No. 2 (See Part I, March issue) on the basis of 65 gallons of non-volatile volume per 100 gallons of paint, rather than 73.69 gallons used in the control paints. This was done because the 109% excess binder white paints were too high in viscosity at 73.69 gallons non-volatile volume. This change effects the rheological properties only since the basic standards of this study were maintained. The formulas and paint characteristics are reported in Table VIII.

Yellow Paints, 100% Excess Binder

Formulas were calculated from the graphs of Figure No. 3 (See Part I-March issue) on the basis of 65 gallons of non-volatile volume per 100 gallons of paint. The formulas and paint characteristics are reported in Table IX.

TABLE VI
WHITE PAINTS, 50% EXCESS BINDER
All figures in pounds per 100 gallons of paint

Formula No.	12–37–1	12–37–2	12–37–3
Raw Linseed Oil	165	103.5	144.5
Z_2 Linseed	110	69	96.5
Mineral Spirits	164	164	164
24% Pb Drier	9.1	5.8	8.0
6% Mn Drier	1.8	1.2	1.6
Anti-skin	1.3	1.3	1.3
Rutile TiO_2	175	175	175
ZnO	174	174	174
ASP 400	645	—	—
$CaCO_3$	—	970	—
Mg Sil	—	—	794
Total	1445.2	1663.8	1558.9
Additional Mineral Spirits	102.5	102.5	156.5
Pounds per Gallon	13.41	15.31	13.72
Viscosity, KU, 77°F.	77	75	91
Fineness of Grind, N.S.	4	5	4.5
% PVC	52.2	70.2	58.4
% Non-volatile Volume	63.9	63.9	57.0

*Research Laboratory, Minerals & Chemicals Corporation of America, Menlo Park, N. J.

TABLE VII

WHITE PAINTS, 109% EXCESS BINDER

All figures in pounds per 100 gallons of paint

	Formula No. 12–38–1	12–38–2
Raw Linseed Oil	134	176.5
Z_2 Linseed	89.5	118.0
Mineral Spirits	164	164
24% Pb Drier	9.6	9.4
6% Mn Drier	2.0	1.9
Anti-skin	1.3	1.3
Rutile TiO_2	175	175
ZnO	174	174
$CaCO_3$	824	—
Mg Sil	—	636
Total	1573.4	1456.1
Pounds per Gallon	15.96	14.53
Viscosity, KU, 77°F.	99	116
Fineness of Grind, N.S.	4.5	4.0
% PVC	61.4	49.1
Additional Mineral Spirits	—	33
Viscosity, KU, 77°F. with above	—	95

TABLE VIII

RED PAINTS, 100% EXCESS BINDER

All figures in pounds per 100 gallons of paint

	Formula No. 12–46–1	12–46–2	12–46–3
Raw Linseed Oil	173.5	85.5	136.5
Z_2 Linseed	116	57	91
Mineral Spirits	220	224	222
24% Pb Drier	9.6	4.8	7.6
6% Mn Drier	2.0	1.0	1.5
Anti-skin	1.3	1.3	1.3
Pure Iron Oxide	62	62	62
ZnO	177	177	177
ASP 400	493	—	—
$CaCO_3$	—	938	—
Mg Sil	—	—	694
Total	1254.4	1550.6	1392.9
Pounds per Gallon	12.48	15.83	14.00
Viscosity, KU, 77°F.	68	72	90
Fineness of Grind, N.S.	5	4	3
% PVC	43.3	72.1	55.4

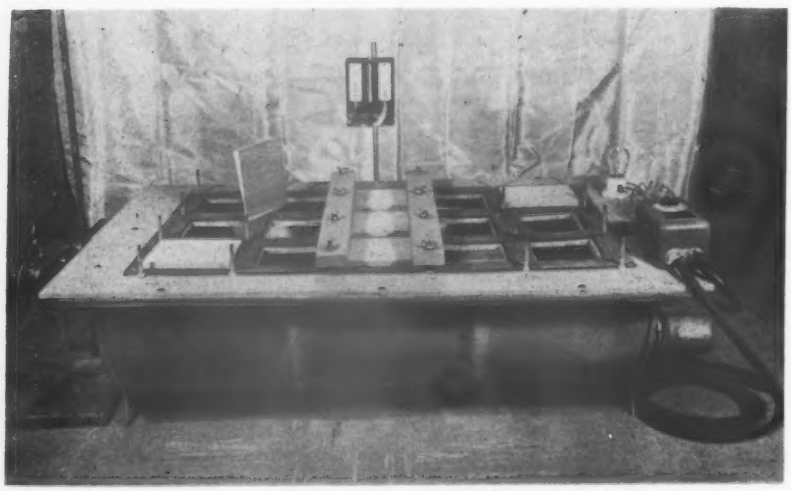

Figure 4. Blister Box.

White Paints, 109% Excess Binder —Pigmentation Proportionate to Control Formula for Each Extender:

This series was formulated as follows: The white paints of Table I (see Part I-March issue) were formulated at 70.5% extender per total pigment volume. The data of Table III (see Part I-March issue) indicated that at the above extender volume, the $CaCO_3$ required a PVC of 53.3% and the magnesium silicate a PVC of 46.6% to obtain 109% excess binder. The paints were formulated at the above PVC's and at 73.69 gallons non-volatile volume per 100 gallons of paint. The formulas and paint characteristics are reported in Table X.

Blister Resistance Tests

Six inch lengths of six inch clear Western red cedar bevelled siding were cut and two coats of each paint were applied to the face of each panel by brushing, and allowing seven days drying between costs. A minimum of four days, after the second coat was applied, was allowed before attaching the panels to a blister box.

The blister box is shown in Figure No. 4. The body of the blister apparatus was made of a half (55 gallon) drum section with feet and supports for the panel mounting stage of angle iron welded in place. A 2000 watt immersion strip heater was fitted to the drum head and placed so that the heater strip was below the water level. A hole was cut in the opposite head to receive the shaft of a fan, the propeller of which was positioned in the vapor space to circulate the vapor and to assure uniform testing conditions for each panel. A thermostatic control was fixed to the panel. A thermostatic control was fixed to the panel stage above the strip heater entrance and on-and-off indicating light positioned behind it. The entire apparatus received one coat of a vinyl metal primer and two coats of chemically resistant vinyl paint. The surface of the panel mounting stage was fitted with foam rubber strips to provide a seal between the test panels and stage. Wood strips drilled to receive bolts mounted in the stage were used to clamp the test panels to the stage with wing nuts.

After all panels were attached to the blister box, the heating element was turned on and the water maintained at a temperature of 96 to 106°F. with the circulatory fan operating continuously for a period of eight days. At the end of this time, the panels were inspected and classified as reported in Table XI. Classification was based upon blistering of the film only. Most panels exhibited an accumulation of brown wood extractive upon their surfaces which could not be properly considered failure; this is due to the intense water vapor pressure at about 100°F. forcing water extractives through the films.

Absorption Tests

Number one, eighteen inch clear Western red cedar sidewall shakes were painted by brushing with two coats of each white paint and allowing four days room temperature drying between coats. After the second coat had dried seven days, glosses were measured using the Gardner 60° glossmeter. Concurrently, 3 mil dry films of each paint were applied to Morest paint charts, using the 3 mil Bird applicator. After seven days drying at room temperature, glosses were determined using the 60° glossmeter. Absorption differences were determined by comparing the gloss of paints on non-absorbent Morest charts with the two coat gloss on cedar shakes.

All the white paints were also tested by the "fried egg" absorption test[10], which measured the absorption of vehicle from the liquid paint by filter paper. The above data are reported in Table XII, the larger measurements indicating the greater vehicle absorption.

Brushing and Leveling Comparisons

Comparisons of brushing of all the white paints on the cedar shakes were classified according to the drag on the brush and the leveling of the dried film. Observations and classifications were determined by one operator and are reported in Table XIII.

Discussion

Viscosity Relationships

The viscosity relationships of the control paints (Table II) indicated that ASP 400 and the Mg Sil

TABLE IX
YELLOW PAINTS, 100% EXCESS BINDER
All figures in pounds per 100 gallons of paint

	Formula No. 12-45-1	Formula No. 12-45-2
Raw Linseed Oil	96.5	136
Z_2 Linseed	64.5	91
Mineral Spirits	223	222
24% Pb Drier	5.4	7.6
6% Mn Drier	1.1	1.5
Anti-skin	1.3	1.3
Med. Chrome Yellow	100	100
ZnO	174	174
$CaCO_3$	821	—
Mg Sil	—	700
Total	1486.8	1433.4
Pounds per Gallon	15.16	14.30
Viscosity, KU, 77°F.	70	92
Fineness of Grind, N.S.	4.0	3.5
% PVC	68.5	55.6

TABLE X
WHITE PAINTS, 109% EXCESS BINDER, PIGMENTATION PROPORTIONATE TO CONTROL FORMULAS FOR EACH EXTENDER
All figures in pounds per 100 gallons of paint

	Formula No. 12-33-1	Formula No. 12-33-2
Raw Linseed Oil	162	185
Z_2 Linseed	108	123
Mineral Spirits	164	164
24% Pb Drier	9.0	10.2
6% Mn Drier	1.8	2.1
Anti-skin	1.3	1.3
Rutile TiO_2	233	204
ZnO	232	204
$CaCO_3$	626	—
Mg Sil	—	562
Total	1537.1	1455.6
Pounds per Gallon	15.25	14.53
Viscosity, KU, 77°F.	82	97
Fineness of Grind, N.S.	4.5	3.5
% PVC	53.3	46.6

TABLE XI
BLISTER RESISTANCE TESTS

Extender	Formula No.	% PVC	% Excess Binder		Color	Rating[1]
ASP 400	12-37-1	52.2	50		White	1 and 3
	12-46-1	43.3	100		Red	1
	12-29-1	40.0	109		White	4
	12-44-1	42.6	105		Yellow	6
	12-30-1	40.0	131		Red	10
$CaCO_3$	12-37-2	70.2	50		White	1
	12-46-2	72.1	100		Red	1
	12-45-1	68.5	100		Yellow	1
	12-33-1	53.3	109	(Control Pigmentation)	White	3
	12-30-4	40.0	445		Red	.8
	12-44-2	42.6	366		Yellow	9
	12-38-1	61.4	109		White	10
	12-29-4	40.0	258		White	10
Mg Sil	12-37-3	58.4	50		White	1
	12-46-3	55.4	100		Red	1
	12-45-2	55.6	100		Yellow	2[2]
	12-44-3	42.6	170		Yellow	5
	12-30-5	40.0	224		Red	8
	12-38-2	49.1	109		White	10
	12-29-5	40.0	174		White	10
	12-33-2	46.6	109	(Control Pigmentation)	White	10

(1) A rating of 1 indicates no blistering with 20X magnification. A rating of 10 indicates uniform covering of entire panel with blisters.

(2) Questionable: panel surface cracked with grain in several places.

Table XII
ABSORPTION TESTS, WHITE PAINTS

Formula No.	Extender	Classification	60° Gloss[1] Morest Chart (A)	60° Gloss[1] Cedar Shakes (B)	% Gloss Difference (B x 100) / A	Inches Absorption[2]
12–29–1	ASP 400	40% PVC Control	83.1	49.6	59.7	11/16
12–29–4	$CaCO_3$	40% PVC Control	71.5	30.1	42.1	10/16
12–29–5	Mg Sil	40% PVC Control	31.5	16.5	52.5	11/16
12–37–1	ASP 400	50% Excess Binder	0.7	0.3	—[3]	1 1/16
12–37–2	$CaCO_3$	50% Excess Binder	0.0	0.0	—	1 3/16
12–37–3	Mg Sil	50% Excess Binder[4]	0.0	0.0	—	1 5/16
12–29–1	ASP 400	109% Excess Binder	83.1	49.6	59.7	11/16
12–38–1	$CaCO_3$	109% Excess Binder	1.3	1.0	—[3]	—
12–38–2	Mg Sil	109% Excess Binder	2.8	1.7	—[3]	—
12–29–1	ASP 400	109% Excess Binder	83.1	49.6	59.7	11/16
12–33–1	$CaCO_3$	109% XS Binder, Control Pigmentation	41.5	8.9	21.4	—
12–33–2	Mg Sil	109% XS Binder, Control Pigmentation	20.0	6.8	34.0	—

(1) All glosses determined by standardizing glossmeter on 52% ceramic tile gloss standard.
(2) Method: Federal Specification TTP-141B; Method No. 442.1, "Fried Egg" test.
(3) Glosses are too low for accuracy. In these ranges the instrument has a sensitivity of about ± 0.3.
(4) Mg Sil added to reduce viscosity.

paints were about equal in this respect. The control paints formulated with $CaCO_3$ were generally lower in viscosity, and with the possible exception of the white formula, were probably too thin to provide pigment suspension, adequate sag control, or film building performance.

At as little as 50% excess binder all of the white paints required additional thinner, and the Mg Sil paints was exceptionally high in viscosity. At the 109% excess binder level both the $CaCO_3$ and the Mg Sil paints were above the generally suitable viscosity range of 75 to 90 KU. (Tables VI and VII.)

The white paints at 109% excess binder using the control pigmentations (Table X) were included in this study to determine the effect of an increase in PVC on weathering characteristics. The viscosities of these paints cannot be properly classified according to extender effect at a specified excess binder level since the $ZnO+TiO_2$ contents are above the standard content for the white paints.

The viscosities of the red and yellow paints at the 100% excess binder level (Tables VIII and IX) indicate that the ASP 400 and $CaCO_3$ paints were low but the Mg Sil paints were at a maximum. It is evident then that the 65 gallons of non-volatile per 100 gallons of paint used in these paints was about optimum.

In this study the extenders have been classified for viscosity effects at specific excess binder levels while attempting to standardize the non-volatile volume per 100 gallons of paint. It was not practicable to maintain a standard non-volatile volume per 100 gallons of paint as indicated by the viscosities resulting with the white paints at 50% excess binder and the red paints at 100% excess binder (see "Experimental"). For this reason the viscosities within each series are comparable, but they are not comparable over the entire study.

With the exception of the control paint, the brushing and leveling properties of the white paints (Table XIII) containing Mg Sil were not within an acceptable range. Reducing viscosities of the Mg Sil paints from initially high values by adding mineral spirits did not improve the application properties.

The white paints containing the $CaCO_3$ exhibited good brushing, leveling properties although they were generally low in viscosity. The $CaCO_3$ paint at 109% excess binder indicated that poor leveling characteristics are developed despite an increase in viscosity.

The white paints containing ASP exhibited good application properties.

Blister Resistance

The use of high oil absorption pigments such as diatomaceous earth has been suggested to "soak-up" excess binder and provide a paint film sufficiently permeable to prevent pressure build-up and resultant blister formation. The data summarized in Table XI are somewhat fragmentary and shows only trends. It demonstrates that at lower PVC's paints containing $CaCO_3$ and Mg Sil have a large excess of binder (beyond CPVC requirements) which impairs blister resistance. The only paints formulated with these extenders which possessed good blister resistance were at the 50-109% excess binder level. These were impractical formulations, because of poor flow properties and very high PVC's.

There is evidence that paints containing ASP 400 at comparable excess binder levels have superior application qualities and give comparable or superior resistance to blistering. In addition, these ASP 400 paints are in the range of PVC which would be expected to provide good weather resistance.

Paint 12-33-2, containing Mg Sil and 109% excess binder, exhibited very poor blister resistance. This paint does not fall into the general range of good blister resistance obtained with the other pigmentations at 50 to 109% excess binder. There are several possible explanations for this and other variances.

The paints were applied without regard to application rates since the viscosities and brushing properties were allowed to govern the thicknesses and properties of the films. The higher viscosity and ropy Mg Sil paints would naturally apply at higher rates and thicker films might be expected to have poorer blister resistances.

TABLE XIII
BRUSHING AND LEVELING COMPARISONS OF WHITE PAINTS

Formula No.	Extender	Classification	Drag on Brush* Over Wood	Drag on Brush* Over First Coat	Leveling** Over First Coat
12-29-1	ASP 400	40% PVC Control	Sl.	V.Sl.	Good
12-29-4	$CaCO_3$	40% PVC Control	V.Sl.	V.Sl.	Good
12-29-5	Mg Sil	40% PVC Control	Sl.	V.Sl.	Good
12-37-1	ASP 400	50% Excess Binder	Sl.	V.Sl.	Good
12-37-2	$CaCO_3$	50% Excess Binder	Sl.	V.Sl.	Good
12-27-3	Mg Sil	50% Excess Binder	Sev.	Mod.	Ropy
12-38-1	$CaCO_3$	109% Excess Binder	Sl.	V.Sl.	Sl. Ropy
12-38-2	Mg Sil	109% Excess Binder	Mod.	Mod.	Ropy
12-33-1	$CaCO_3$	109% XS Binder, Control Pigmentation	Sl.	V.Sl.	Good
12-33-2	Mg Sil	109% XS Binder, Control Pigmentation	Mod.	Sl.	Ropy

* V. Sl. — Very Slight
Sl. — Slight
Mod. — Moderate
Sev. — Severe

** Good — No visible brushing lines
Sl. Ropy — Brushing lines visually apparent
Ropy — Brushing lines appear as pronounced ridges and valleys.

Adjusting these paints to apply at equal rates would have introduced additional variables which should properly be subjects for separate study.

Absorption Tests

The gloss ratios listed in Table XII indicated that of the 40% PVC control paints, the ASP 400 paint demonstrated superior hold-out. However, the absorptions were in almost the reverse order. The absorption test is an established test but is not sufficiently accurate to permit measurement of small differences where low viscosity vehicles are concerned. Gloss measurement has been used to assess small differences in hold-out and was considered the better basis for classification. It was noted, that the 50% excess binder paints had higher absorptions for lower vehicle solids contents, although the Duramite paint, which had the lowest vehicle solids content, did not have the highest absorption as would be expected.

The gloss ratios for the 12-33-1 and 12-33-2 formulas with the control pigmentation were still lower, in order of their vehicle solids contents.

CPVC, White Outside House Paints

The data of Table V indicate that a maximum difference in CPVC of 1.0% was evident in the columns in which different extenders were examined with each ZnO and TiO_2 level. (BNK vs. Fibrene C-400 at maximum TiO_2.) Since the extender volumes are constant, it is apparent that there was very little difference in the packing of the ZnO and TiO_2 with this series of extenders at the proportion of extender used. This was further substantiated within the series for each extender, the maximum difference in CPVC being 2.7% for the BNK.

An extension of this study to investigate CPVC with widely divergent extenders would establish a full range of values of CPVC and the effect of ZnO and TiO_2 through the range employed in this investigation on the effects of weathering.

CPVC, Shingle and Shake Paints

There is an alternative conception of the meaning of "excess binder" to that upon which this work is based. In this study excesses were calculated as a proportion of the binder required at the CPVC. At the CPVC all pigment blends may be considered to be equal according to definition, so equal volumes of excess binder might be expected to produce equal binder effects. This may be called an equal excess binder concept. An examination of ASP 400 and $CaCO_3$ using this basis follows:

ASP 400 at 70.5% extender/pigment volume = 58.2% CPVC

$CaCO_3$ at 70.5% extender/pigment volume = 70.5% CPVC

At equal excess binders:

ASP 400: 58.2+41.8+41.8 = 141.8 = 100.0% excess binder

$CaCO_3$: 70.5+29.5+41.8 = 141.8 = 141.8% excess binder

This method of calculation would then result in paints which would be between the 50% excess binder levels and the control paints of this report, since the control paint for Duramite was 258% excess binder.

The blister resistance tests discussed above revealed that from 50 to 109% excess binders the paints exhibited comparable properties. It appears then that the propensity of a blend of pigments for absorbing binder is a significant influence in paint film porosity.

Economic Aspect

As shown in the calculations above, the non-volatile volume per 100 gallons of paint can be increased while maintaining the other factors constant. This provides a practical aspect for this study since the non-volatile volume may be varied as required to obtain the best application properties for each paint. The paints thus adjusted would represent practical formulations upon which accurate cost appraisals could be based.

Conclusions

All the white control paints (40% PVC) exhibited good brushing and leveling properties.

In the range of 50 to 100% excess binder, the ASP 400 paints evidenced good brushing and leveling properties and viscosities within a generally suitable range. The calcium carbonate and magnesium silicate paints were either borderline or beyond the generally ac-

(*Turn to page 102*)

DOW | LATEX

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THE COATING CORNER

By
Phil Heiberger

The author continues his random reflections on various aspects of the paint industry. The opinions expressed in this column are his alone and do not necessarily reflect those of this publication.

News of the Race

WHEN H. G. Wells said, in 1920, "Human history becomes more and more a race between education and catastrophe," he expressed a thought that troubles many American minds today. The problem, as we now see it, is how to teach so much to so many in so little time.

P. Heiberger

True to form, America seems to be coming up with satifsactory solutions to what is, in the final analysis, simply another in a long line of knotty mass production problems. Like most of its predecessors, this problem should dissolve eventually before the onslaughts of those two old reliable aggressors, imagination and ingenuity.

The good news is that the challenge of the age is being met head-on, and new concepts and techniques combining economy, efficiency, and effectiveness are rapidly being devised, tested, and put into use in all phases of the broad field of education.

Of particular interest to scientists and technical workers are three relatively new developments: 1) educational films, 2) educational TV, and 3) teaching machines. The December 1959 issue of the *Journal of Chemical Education* abounds with descriptions and discussions of their merits, applications, and potentialities. Although the three methods have been developed primarily for school and college instruction, they contain many ideas readily adaptable for use in industry.

Films

Tentative experimental data has shown that educational films and television can fill a definite need in the classrooms of the nation, particularly in chemistry and other scientific subjects. The latest trend is toward the use of films for representation of an entire course, instead of merely for supplementary material, as formerly.

Researchers found that students who took an entire course via films gained as much knowledge and achieved as much understanding of the subject as those who learned in the usual way. Especially interesting was the finding that students who had had film demonstrations of laboratory technique and experiments in lieu of the actual laboratory work, considered until now *de rigeur* in introductory courses, performed as well in more advanced courses as those who had received their training first hand.

It's true one learns by doing, but the opportunity of observing in film close-ups the proper techniques of manipulating laboratory equipment helped students to avoid the usual awkward and time consuming initial efforts. Students saw these laboratory films twice in rapid succession. By the time they had the opportunity of handling the laboratory equipment and performing experiments themselves, they had seen enough film demonstrations to approach their assignments with a certain degree of aplomb alien to most novices. The resultant saving in instructors, laboratory space and facilities, and general expenses is obvious and gratifying.

Courses on film can be more flexible and adaptable than one might at first suppose. Self-contained units of study can be inserted, deleted, or substituted with ease in order to suit the purposes, aims, and abilities of various categories of students. As with text books, out-of-date units can be revised or replaced from time to time. The total effect, therefore, can be individually tailored versions of the same basic course.

Television

Complete courses have been presented on television, too. In eliminating the extra intermediate step necessitated by the development of the film before it can be projected on screens for viewing audiences, TV can be more responsive to sudden changes, newsworthy influences, and day to day audience reaction. It means that while the material is freshly prepared and presented at each session, giving an air of immediacy and allowing at least a minimum of interaction between instructor and student body, nevertheless many groups of varying sizes and at widely scattered locations can attned the course simultaneously. Kinescope recordings also permit exact repetition when desired.

The great advantage here is that one instructor can reach so many students, also that the bulk of his time can be devoted to study of the subject and painstaking preparation of material for maximum effectiveness of presentation. This relieves the instructor of the monotonous task of repeating the same facts and experiments time and time again. The "front-row seat" afforded each

TV viewer is a decided boon too. Preliminary findings indicate that television offers almost unlimited opportunities to broaden the scope, depth, and breadth of the curriculum.

Teaching Machines

The most exciting and promising innovation of all, however, is the development of the ultimate educational tool, the teaching machine. Based on essentially simple principles, the teaching machine makes use of facts and understandings of educational psychology that have come to light in recent years as a result of extensive research.

Now that research data have shed needed light on how learning actually occurs, making possible a clearer conception of the factors favoring its occurrence, the following conditions have been recognized as desirable: 1. The learner participates actively in the learning process. 2. Reward and punishment for appropriate or inappropriate responses and behavior are meted out immediately without loss of impact resulting from delay or vagueness. 3. The learner proceeds at his own pace. 4. Misconceptions and failures in understanding are caught promptly and corrected before they can interfere with subsequent learning.

In effect, the teaching machine operates as a private tutor who questions the student on every point to be covered and expresses approval or disapproval at every step of the way. The beauty of it is that it is essentially low in cost and requires only a minimum number of teachers to plan logically arranged programs while students achieve maximum learning.

The teaching machine idea is catching on like wildfire. Several types are now available and more are being readied for manufacture and distribution. Although gadgets of this type have been popular for many years (notably, children's Electric Questionnaire sets and adults' "Autobridge"), it is only recently that attempts have been made to adapt the basic ideas to use for presentation of school courses.

The following paragraphs are excerpted from Jesse H. Day's article, "Teaching Machines," in the December 1959 *Journal of Chemical Education*.

"While there is an infinite variety of actual machines, they all function in the same general way. The learner is first presented with some idea and asked to reach a conclusion about the idea. He may then construct his answer and compare it with other machine information for correctness; or he may choose one of several answers presented by the machine. When the answer is chosen, the machine presents an opportunity to discover whether the answer is correct or not; and in some types of machines not only that the answer is correct, but *why* it is correct, and if it is wrong, *why* it is wrong. The learner persists until he gets a right answer, and then the machine uses the new information added to the original information to elicit a response to a new and more complex situation.

"The advantages (of a multiple choice machine) are worth consideration. When the student selects the right answer, the machine can not only tell him that he is right, but can recapitulate the correct train of reasoning, providing confirmation and repetition. For a wrong answer, the machine can tell why the answer is wrong, repeat the relevant ideas, and give the student another chance."

One machine program involves the use of incomplete sentences printed radially on a paper disc. The disc is mounted in the machine, which exposes one item at a time. If the student completes the sentence correctly, "the lever is moved to the right, which punches a hole in the answer paper and advances the program to the next item. A second time around, the machine stops only at the items missed the first time."

Although actual machines are probably preferable, "less mechanized methods are equally effective for the learner who is seriously bent on learning a new field, especially if it is on-the-job training.

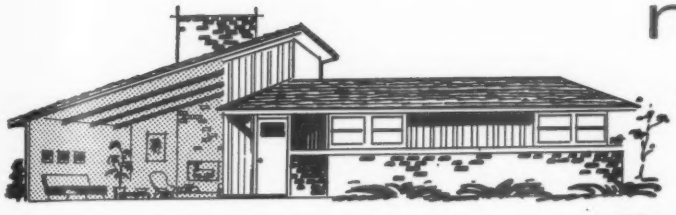
"Experiments with teaching machines are being carried out on a wide scale. Various branches of the armed services see in them a means for teaching many subjects faster and more thoroughly, and industry looks for a means to teach specialized information needed for various jobs with less expenditure of time, money and teaching talent, and schools are experimenting to develop programs for courses.

"The armed services have found with teaching machines that new recruits could be taught trouble-shooting on a particular complex radar outfit in less than half the twelve weeks required by lecture and field work, with more effective results."

The desirability of developing teaching machines for use in the paint industry seems obvious. They could be used to advantage in the training of new employees, both professional and non-professional. Industry-wide organizations could prepare teaching machine programs that would ensure knowledge and understanding of certain ideas, facts, machinery, and laboratory equipment in general use throughout the industry.

Benefits would be two-fold. Time would be saved for both the new employee, who would learn his job more quickly, and the veteran employee, who is customarily taken away from his regular duties in order to familiarize newcomers with typical plant facilities. Of course, an individual company could add special charts and other pertinent data unique to itself, but the basic program could be prepared cooperatively for the use of all members of the industry.

Not only could new employees learn at their own rate without dissipating the time and energies of others, older employees could take the course too, from time to time, to learn about other branches of the company or industry and for refreshers. Workers could discard their narrow views of their own particular niches, substituting a better perspective of their place in the scheme of things. This could not help but increase personal contributions to the whole. Once such machines were universally installed, periodic review charts and recent developments could be organized to assist employees in the gigantic task of keeping up to date in an organized fashion instead of relying on haphazard reviews and chance encounters at society meetings.



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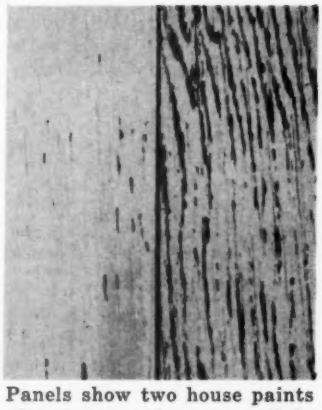

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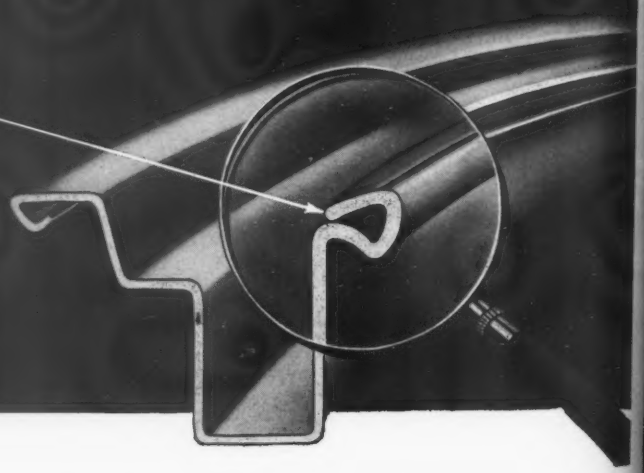

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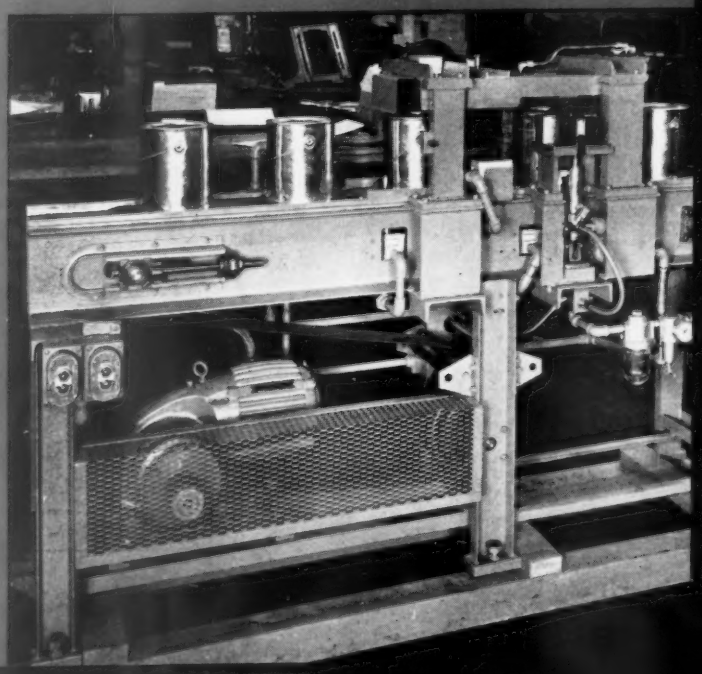

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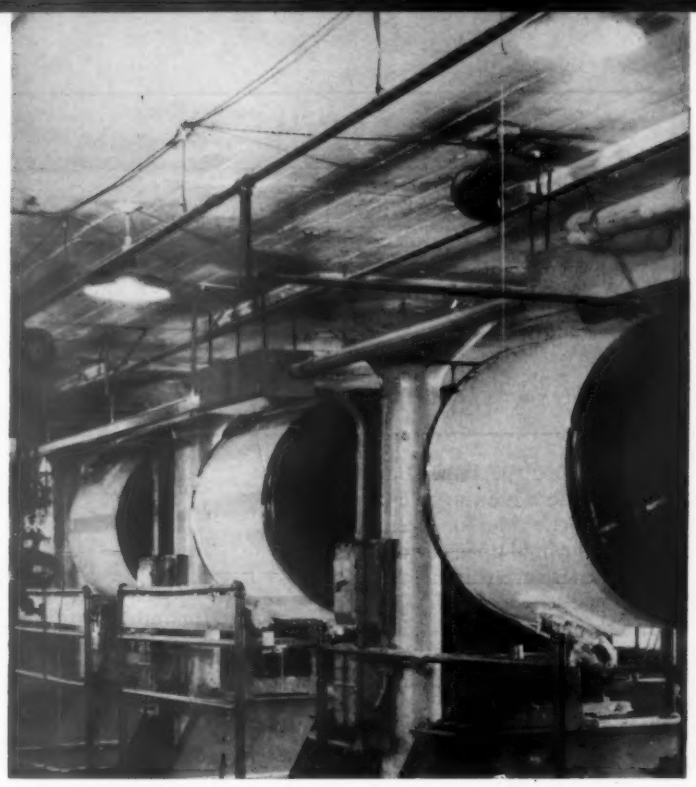
BALL MILL OPERATION

Part II

By

R. H. Jebens*



Vehicle Viscosity

The viscosity of the vehicle should be as low as can be permitted by the dispersion. A good start is to use the Daniel method of determining the maximum solids content to use during the dispersion period. A description of this method is given in Bulletin No. 744 of the *National Paint, Varnish and Lacquer Association*. Further information is given in Bulletins No. 745, 753 and 766 of the same source. The procedure is simple and once in use in the plant, requires very few tests. The different pigments in general range in vehicle solids requirements from 10 to 20%. It will be noted that the vehicle solids value obtained by the test is the maximum and in many cases can be reduced to half these values without difficulty later due to seeding out of the resin when thinning the batch. With vehicles of lower solids content, it is generally desirable to use lower solvency solvents, less polar solvents, or both in order to obtain the flocculated state desired.

It will be noted that the authors Daniels and Shurts recommend a consistency of grind of 80 to 90 KU from the results of their study. This finding is based on the use of one inch Porox Balls or half inch steel balls.

The vehicle viscosity can be further reduced by permitting the temperature of the batch to rise to some selected maximum temperature. Many mills are operated with cooling water outlet held to a constant value to obtain this temperature to assure the same results year around, and to conserve water.

Dispersion Consistency

There has been a growing need for operation of ball mills at controlled consistencies and a definition of a basis for the value used. Much of the laboratory work in ball mills is based on the use of one inch Porox balls and half inch and smaller steel balls.

Test work in the laboratory was carried out to determine the relationship between ball wear and consistency. It was found that if the ratio of the square of the diameter of the ball and the consistency was held constant that the weight per cent loss would be the same. For example, a half inch Arlcite ball tested in a formula at 63 KU had the same wear rate as a 1¼ inch ball at 125 KU. This result seems logical if we remember that the formula for determining viscosity by the falling ball method has this same relationship. In this test the same terminal velocity of two balls of different size falling in tubes of same size will be obtained if the difference in viscosities are related as given above.

From this consideration we have then arrived at minimum consistency required for dispersion, as given in the Table I below, if the wear rate is to be held to low values of about five to eight percent per wear. The balls will wear at this low rate or some higher rate as the viscosity is decreased until, when water or solvent alone are used, the wear rate will be between 0.1 and 0.5 percent per hour.

While the minimum consistency was determined on the basis of wear rate, no maximum limit has been established. In one particular case, one inch balls of Arlcite have given best results operating at a consistency of 135 KU.

The benefit derived from the use of high consistencies is to increase the pigment loading into the mill, and generally to decrease the time

*Application Research, PattersonFoundry and Machine Co., East Liverpool, Ohio.

TABLE I
CONSISTENCY OF FINISHED DISPERSION

Ball Diameter Inch	Porox	Arlcite	Steel
1/2	55–63	63–72	101–111
5/8	63–77	70–80	114–124
3/4	78–87	94–104	125–134
1	96–105	111–121	141–151
1 1/4	109–118	125–135	—
1 1/2	120–129	135–146	—
2	137–146	—	—
Density gm/ml	2.38	3.3	7.85

to obtain the dispersion. Balanced against these advantages, must be considered the time for discharging the mill, the hold up in the mill, and rarely the size of equipment used to thin down the batch. The high consistencies are also subject to more fluctuation due to inaccuracies in weights and impurities.

Mill Speed

A plot of mill speed as a function of critical speed, indicates the horsepower requirements are roughly proportional to the speed up to a critical speed of 50% as indicated in Figure No. 3. The power required for 30, 40 and 50% ball loading is indicated. The power is less than the linear relationship above a critical speed of 50% and reaches a maximum value at 82% of critical speed. The speed for wet grinding has been selected to be between these two values, and was finally chosen on the basis of experience. For steel ball mills, the speed selected is 65% of critical speed, while for lined mills, 60% of critical speed was selected. As the lining of the mill wears away the speed approaches the 65% of critical speed.

Indicated in Figure No. 3 are the speeds at which the outer row of balls were observed to break away from the mass of balls and cataract to the toe of the heap; i.e. the balls are thrown outward above the incline and drop upon it at some point further down. These data were obtained for solvent slurry system with baffles. For 50% ball charge this was at 68% of critical speed, whereas for 30% ball charge this was at 63% of critical speed.

In a pigmented system, the cataracting is much more difficult to see, and if the consistency of the batch corresponds to values given later in the paper, this is at about 70% of critical speed in unbaffled mills. When a Newtonian liquid of 1500 centipoise is used, this value for initial cataracting of the balls occurred at 50% of critical speed. The outer row of balls centrifuges around the mill at 65% of critical speed with this Newtonian liquid. This is the reason that liquids of Newtonian viscosity can not be substituted for a pigmented system to study the action in a ball mill.

When critical speeds of 65% and 60% are used for steel balls and ceramic balls respectively, optimum results can be obtained for grinding and dispersion. No baffles are required and the greatest amount of shear force due to spinning of the balls is obtained. The apparent volume of balls seems to increase at these speeds as compared to operation at 50% of critical speed.

Ball mills to give long time maintenance free operation should use babbitt bearings and fine tooth gears. A lined mill illustrated in Figure 4 has self aligning babbitt bearings that have the trunnions machined at the same time that the ring gear is machined to have good alignment of the drive and bearings. The drive is on a common base and set at an angle to permit adjustment to maintain proper gear tooth contact.

The higher mill speed decreases the processing time more than would be expected from a con-

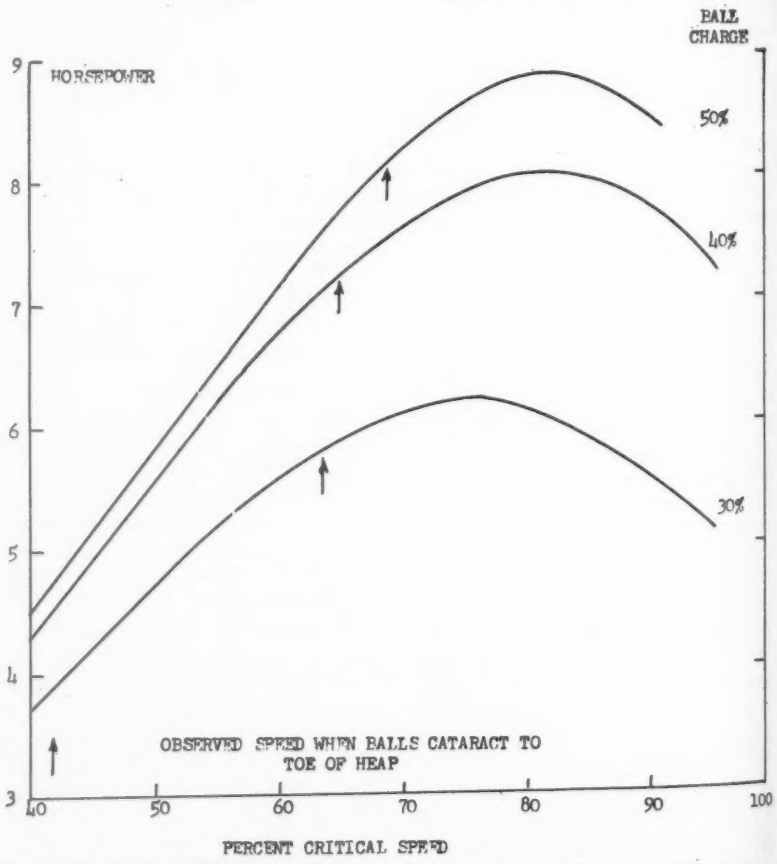


Figure 3. Variation of power requirement through range of speeds with changes of percent ball charge.

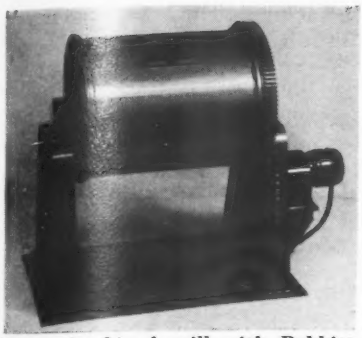


Figure 4. Lined mill with Babbitt bearings.

sideration of power increase alone. In a ceramic mill where the speed is changed from 50% to 60% of critical speed, the processing time should be about 80% of that formerly required. When fine products such as clays are dispersed, this decrease has been observed to be as much as 60% of the time. This result may be due to the higher shear rate produced by the balls and by the increased mixing obtained when large batches are prepared. Many operators use a material to void ratio of 3 to 1 and in such cases mixing of the pigment and liquid may require a considerable portion of the grinding cycle. The higher mill speed decreases this mixing time.

Ball Charge

The choice of size of ball charge is primarily a consideration of slippage between the mill shell and the balls. With a low ball charge, 33%, the slippage at 60% of critical speed is about 12%. This is measured by the power input to the mill and can be eliminated by the use of large baffles—twice as high as the diameter of the ball. On the other hand, a 50% ball charge at 60% of critical speed has a slippage of about 2%. The use of baffles in this case would show very little benefit.

In the manufacture of balls it is necessary to wear balls rapidly to produce a smooth ball. For this purpose, a low ball charge of 20-30% is used and will result in rapid wear and smooth off the imperfections in a short time. Conversely, a high ball charge will show little wear, and 50% ball charge requires about ten times as long as a 20% ball charge and when ground in water.

Gow et al (Trans. American Institute of Mining and Metallurgical Engineers, *87*, 81-87 (1930),) reported the first extensive study of bath milling nearly thirty years ago and suggested that ball charges above 45% of the volume of the mill would show little slippage if no baffles were used. This was substantiated for wet grinding using grinding consistencies. Because steel balls show less slippage than ceramic balls; ball charges for steel of 45% have been selected as most favorable, while for ceramic balls 50% charge is used.

Baffles or Lifter Bars

Directly associated with ball charge volume is the question of the use of baffles in the ball mill. When above ball volumes are used and speeds as given later, there is no need for baffles. When operating mills at lower ball loading and lower speeds, it is desirable to use baffles. These baffles should be welded to the shell and terminate at least one ball diameter from the head of the mill. The baffles to be effective should be not less than two ball diameters high. A disadvantage of the baffles is the more rapid wear of the shell in back of the baffles. The baffles when waved. as in the Patterson mills, show less wear in these areas, but at the same time do not prevent slippage as well. The best arrangement is to use no baffles with the higher speeds and ball loadings and thus reduce the shell wear.

Ball Size

Probably the most controversial problem arises in the selection of ball sizes. If the selection of ball size is based on consistency of grind than replacement costs are low and the question is not so important. However, there is a tendency to buy large balls because they are cheaper, and more wear can be obtained from large balls than from the smaller balls. Fortunately, the balls are not used to wear them to smaller balls, but to obtain a dispersion and the use of large balls is steadily decreasing. Table II indicates the change in size required for various size balls to obtain the use of half of the weight of the ball. A rather nominal change in diameter results in a large weight change.

It is suggested that ball volumes in the mill be brought up to operating level every three months and once a year the undersize be removed. The balls should be culled close to the 50% values of the weight of the balls originally charged to the mill as indicated in Table 2. It has been observed that when balls are used longer than this, the mixture of balls results in higher wear rates. The small balls culled out of each batch should be saved and used for special mills in which products of lower consistency are dispersed, or sold to operators who use smaller sizes.

TABLE II

Diameter of Ball at 50% Original Weight	
Diameter of Ball Charged (Inches)	**Diameter of Ball When Half Used (Inches)**
1/2	0.40
5/8	0.50
3/4	0.59
1	0.79
1 1/4	0.99
1 1/2	1.18
2	1.58

If this procedure is used, the question of a mixture of ball sizes does not come up. A mixture of ball sizes results in higher ball wear and may be necessary where no control or formulation of the product is practiced. In any case, where the practice has been to use a range of ball sizes, it is suggested one mill be tried with only the smallest size ball in the range of sizes to be used and the result will be so markedly better that all future make up balls will be the smallest size ball formerly used.

The size of ball used in the mill may be dictated by the size of the openings in the mill discharge grate, the viscosity of the vehicle, the amount of paste retained in the mill upon discharge, and the rate of mill discharge. As the vehicle solids of the paste in the mill decrease the hold up in the mill decreases and smaller balls are used.

In tests with 0.5 inch and 1.25 inch Arlcite balls, the time to obtain a fineness of 7.5 Hegman North fineness was found to be 4 and 18 hours respectively. This test was made at consistencies of 63 and 115 KU in a pigment resin solvent system using 18% vehicle

solids. In another test with steel balls 19/32 inch balls required half the time to obtain a dispersion as 1.0 inch steel balls. Both of these tests were made at 50% ball loading and mills operating at 65% of critical speed. The material to void ratio was 1.1 in both tests.

These tests show that the time of dispersion is inversely proportional to the area of balls per unit volume. This is the result expected if the dispersion is accomplished primarily by shear due to spinning of the balls. The much shorter processing time that results from the use of small balls is very rewarding. Factors that limit the ball size as mentioned earlier can often be corrected.

The openings in the discharge grate can be reduced to ¼ inch slots, and not interfere with the free discharge of the mill. A study of mill additions for "let-down" will result in obtaining a paste of low consistency that is free flowing and has low vehicle solids. This paste will then show very little hold-up or product in the balls even though small balls are used.

Material to Void Ratio

The volume of voids between the balls of uniform size as used in a ball mill is approximately 40% of the volume occupied by the balls. To just fill the voids of the balls in a mill filled to 50 percent of the volume with balls, requires a slurry volume of 20 percent of the mill volume. The shortest possible dispersion or grinding time is obtained when a paste volume of this size is used. If a smaller volume is used, excessive wear of the balls may result.

In general, for batch operation, material volume to void volume of 2.0 to 2.5 is usually used. For a 50 percent ball charge this would be 70 to 80 percent of total mill volume filled with balls and material. Some 30% of the mill volume would be actually balls and 40 to 50 percent of the mill volume would be material in the interstices and above the balls. Amount used may be dictated by volume of the dry pigment when charged.

The use of material to void ratios of more than one, usually results in proportionately longer time for dispersion. With material to void ratio of two, the time for the dispersion to be completed, is usually twice as great as when a material to void ratio of one is used. There are exceptions, however, and in some cases dispersions with higher material to void ratio have taken very little more time than when the ratio was one. On the other hand, with solids of low bulk density in particular, the dispersion time may be greater than expected.

The range of the size batch that may be processed in the ball mill is rather high. It is possible to produce smaller batches for rush shipment when required, or to produce larger more economical sized batches in the ordinary operating schedule.

Ball Density

The balls of higher density are effective in reducing dispersion time if smaller balls are used. The rate of movement of balls as affected by the force of gravity is proportional to the area of the ball and the difference in density between the solid and the liquid. A low density ceramic ball, such as Porox, has six tenths the density difference of a high density or Arlcite ball. When changing over to a high density ball the use of smaller balls, 77% of the diameter of the Porox balls, will give the same ball action as was obtained with the Porox balls. If this practice is carried out, then grinding times will be reduced to two thirds of that required for the lighter balls. If balls of the same size were used, and the wear qualities were the same, then more grit will form when high density balls are used, and grinding times are extended in an attempt to eliminate the grit.

The wear of balls when over sized is generally not uniform and will tend to form a twelve sided shape. When flat sides are produced, corrective action may be obtained by the use of smaller balls, lighter balls, change in formulation to increase consistency, slowing down the mill and using larger ball charges. Some of these changes will result in longer dispersion time and others in shorter dispersion time, but it is possible to make the balls wear uniformly. Ball wear to form odd shapes, is a criterion of poor ball mill practice.

Some operators seem to have difficulty due to breakage of balls. Usually this is due to large variation in size of balls, low consistency, low vehicle viscosity or high ball density. The high density ball must be tougher, if one or other factor is not changed, to fit the system to the use of high density balls and avoid breakage.

Mill Diameter

The mill diameter must be considered as a variable in the handling of dispersions. The power input to larger mills, increases at a faster rate than the volume so that more work is being done per unit volume. When mills of different diameter are operated at the same percent of critical speed, the horsepower requirements vary as the 2.6 power of the mill diameter. The volume of charge in the ball mill varies as the 2.0 power of the mill diameter. If the power were effectively used to wet new surface only, the time for the dispersion can be reduced. This has been found to be true for paints where the material to void ratio is one. A higher material to void ratio, not all the expected reduction in dispersion time is achieved, possibly due to poorer mixing of the ingredients. The relative time for dispersion in larger mills is indicated in Table III.

Operation of the Ball Mill

The charging of ingredients into the ball mill should be done in such a manner as to avoid contact between the pigments and the high viscosity liquids. The pigments have a high absorption power for the solvents in the high viscosity liquids. This leaves the resins in nearly solid form which will then occlude the balls into large masses. Several techniques can be used to avoid this contact:

TABLE III

Relative Time For Dispersion

Mill Diameter, feet	Relative Time for Dispersion
1	1.0
2	0.67
3	0.53
4	0.45
5	0.38
6	0.34
8	0.29

1. Premixing of the liquid ingredients in separate tanks. The use of base solutions for this purpose is very common.
2. Premixing the solvent and resins in the ball mill, before adding the pigment.
3. Premixing all the ingredients that go into the ball mill in vertical dispersion mixers.
4. Addition of the resin solution, then the solvent and finally the pigment.
5. The addition of the ingredients to the mill should be done rapidly and the mill started as soon as possible.

Where only a few formulae are made in one mill, it has been found expedient to premix the ingredients in a vertical mixer. For this purpose a mixer having an agitator requiring about 0.8 H.P. of power per 100 gallon of mix gives excellent results. Solvent and pigment are usually mixed and the resin or varnish added last. Nearly all the dispersion can be accomplished in this type mixer and the ball mill is required to do only a small part of the total job. For fineness of 4 or 4½ it is sometimes possible to accomplish the entire dispersion by this method.

The impeller used for this mixing can be one of several designs and should have a large sweep, compared to the vessel diameter. Usually 65 to 75% of the vehicle is charged and all the pigment to make a very heavy paste. In a short time a smooth, buttery paste is produced and the rest of the solvent added, to bring the consistency to ball mill usage.

The use of mixers with more power available for agitation than the conventional paint mixing tank for making up the final product is very convenient. Sufficient power is available to blend in tinting colors in fifteen minutes. Additions of solids and heavy resin solutions can be made and a smooth mix obtained in sixty minutes. The operator thus has mixers available for thinning his product and uses the ball mill, the most expensive piece of equipment, for dispersing and grinding the pigment to the product desired.

Ball mills when in operation, tend to heat the product being dispersed and then raise the pressure in the mill. The gas released from the surface of the pigment also rasises the pressure in the ball mill. For this reason, the mill should be vented about an hour after the dispersion has been started. The venting decreases the partial pressure of the fixed gases and so helps to desorb the gas from the surface of the pigment. Vent plugs that can be opened for release of gas pressure are usually available at both ends of the ball mill. With solvents of high vapor pressure, or if cooling water is not used, it is sometimes necessary to vent the mills a second time, about four hours after start up.

The ball mills are cleaned by addition of solvent after the mill is unloaded. If possible, this solvent should be such that it can be added directly to the product and thus make certain all the solids intended are used in the batch. Sufficient solvent to fill all the voids is not necessary. It is very important that the mill be operated only a few minutes to keep the wear of the balls to a minimum. Usually one washing is sufficient, unless there is a major color change and the new and old colors when mixed, form grey.

Conclusion

The ball mill is an efficient machine for dispersing and grinding pigments, if it is handled to advantage. Results of years of development, indicate that many factors must be considered in order to obtain the best use of this adaptable piece of equipment, used for reducing pigments to size, preparing paint, ink, coatings, enamels and ceramic products. Optimum operating results usually are obtained with the following conditions:

1. The ball charge should be 45 to 50% of the total mill volume.
2. Balls of a uniform size and as small as practical should be used.
3. The mills should be operated at about 65% of critical speed.
4. Careful balance of physical-chemical properties are required to produce flocculates of the sizes desired.
5. Vehicles should be maintained at lowest viscosity possible.
6. The consistency of the paste should be above some minimum value, dependent upon the ball size and desnity used.
7. The ratio of the volume of material to voids, can be varied over a wide range from one to two and a half.
8. No baffles are required in mills with the above conditions.
9. High density balls are more effective in the preparation of a dispersion, or for reducing particle size, than balls of lower density.
10. The dispersion time is shorter in large diameter mills then in laboratory mills.

A change of any one of the above factors may require a change in some other factor in order to maintain the most effective performance. Generally, it is desirable to select the mills, mill speed, ball charge, size ball and the density of the balls and then to fit the formulation to the physical arrangement in the plant. Pilot and laboratory equipment should correspond to the conditions selected for plant operation to permit easy translation from small scale to large scale.

STATISTICAL METHODS

Part II—Conclusion

By

Lawrence Shatkin

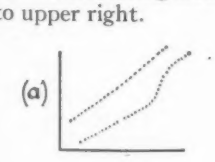
Correlation

Correlation exists when there is a definite tendency for two or more variables to vary together. Two variables are called simple correlation; it may be either linear or curvi-linear. In a linear relationship the slope is constant throughout, while a non-linear relationship has a slope that is not constant throughout.

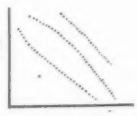
The primary objective is to give us some dependable basis for making estimates. The standard deviation serves as a basis for the probable variability of such estimates. Correlation enables us to establish some kind of a rule or law of relationship whereby the probable value of one of the variables can be estimated on the basis of a known or estimated value of the other variable. Correlation can be direct, in which case the variables are moving in the same direction, or it can be the reverse.

Steps in Linear Correlation

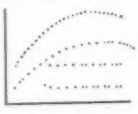
1. (a) Positive correlation is depicted as a clustering from lower left to upper right.



(b) Negative correlation is the inverse of a.



(c) A series having no correlation is shown as:



2. The Line of Regression is determined by an estimating equation:

$$\Sigma Y = Na + b\Sigma X$$
$$\Sigma XY = a\Sigma X + b\Sigma X^2$$

3. The standard error of estimate is calculated by:

$$S_Y = \sqrt{\frac{\Sigma(Y-Y_c)^2}{N}}$$

4. The coefficient of correlation, r, is determined by:

$$r = \sqrt{1 - \frac{S_Y^2}{\sigma_Y^2}}$$

The above graphs are sometimes referred to as a scatter diagram in which one variable is plotted graphically on the X-axis, and the other on the Y-axis. If there is a high degree of association the scatter will be confined to a narrow "path."

Line of Regression

If the data is linear the resulting equation will be $Y = a + bX$, which resolves into two equations that can be solved simultaneously:

$$(1)\ \Sigma Y = Na + b\Sigma X$$
$$(2)\ \Sigma XY = a\Sigma X + b\Sigma X^2$$

Equation (1) is obtained by summing up all points, resulting in $\Sigma Y = \Sigma a + b\Sigma X$. However, a, being a constant, equals the number times the constant, giving $\Sigma a = Na$. The second equation (2) is obtained by multiplying both sides of the equation $Y = a + bX$ by X, obtaining $\Sigma XY = a\Sigma X + b\Sigma X^2$.

Least Squares Method-Linear Correlation

$$Y = a + bX$$
$$(1)\ \Sigma Y = Na + b\Sigma X$$
$$(2)\ \Sigma XY = a\Sigma X + b\Sigma X^2$$

Substituting the figures from Table I we get,

$$(1)\ 111 = 15a + 69b$$
$$(2)\ 444.75 = 69a + 375b$$

Multiply (1) by 69
$7659 = 1035a + 4761b$
Multiply (2) by 15
$6671.25 = 1035a + 5725b$

Subtract $987.75 = -864b$
$b = -1.14$
Substitute in (1) $111 = 15a + 69\ (-1.14)$
$a = 12.64$
Therefore, $Y_c = 12.64 - 1.14X$

This is the line of relationship or regression equation. This represents a line, so drawn, that the sum

The opinions expressed in this feature are not necessarily those of any particular firm or organization.

Table I—Computation of regression equation—Least Squares Method

Company	Average Rates in ¢ per KWhr X	Annual Consumption in 100 KWhrs Y	XY	X^2
A	3.5	8.0	28.00	12.25
B	7.5	4.5	33.75	56.25
C	8.0	3.5	28.00	64.00
D	6.5	4.0	26.00	42.25
E	2.0	10.0	20.00	4.00
F	3.5	9.5	33.25	12.25
G	5.0	6.0	30.00	25.00
H	4.0	8.5	34.00	16.00
I	6.5	5.0	32.50	42.25
J	6.0	6.5	39.00	36.00
K	5.0	8.0	40.00	25.00
L	1.5	11.0	16.50	2.25
M	2.5	9.0	22.50	6.25
N	5.0	7.0	35.00	25.00
O	2.5	10.5	26.25	6.25
Total 15	69.0	111.0 (2)	444.75	375.00

Table II—Extension of Table I

Company	100 KWhrs Estimated Y_c Theoretical	Deviations or Errors of Estimate $Y-Y_c$ (d)	Standard Error of Estimate $(Y-Y_c)^2$ d^2
A	8.7	−.7	.49
B	4.1	.4	.16
C	3.5	0	0
D	5.2	−1.2	1.44
E	10.4	−.4	.16
F	8.7	.8	.64
G	6.9	−.9	.81
H	8.1	.4	.16
I	5.2	−.2	.04
J	5.8	.7	.49
K	6.9	1.1	1.21
L	10.9	.1	.01
M	9.8	−.8	.64
N	6.9	.1	.01
O	9.8	.7	.49
			6.75

Table III Sales, Test Scores, and Years of Experience for the Ten Salesmen of the XYZ Company

Salesman	Sales (0000 dollars) (1)	Test Score (2)	Experience (in years) (3)
1	6	5	3
2	6	4	5
3	5	6	5
4	4	3	3
5	10	7	6
6	12	9	11
7	8	5	9
8	9	8	8
9	9	6	10
10	11	7	10
	80	60	70

of the squares from the vertical deviations is a minimum.

The scatter or error of estimate is obtained by the equation:

$$s_Y = \sqrt{\frac{\Sigma(d)^2}{N}}$$

$$= \sqrt{\frac{6.75}{15}}$$

$$= \sqrt{.4489}$$

$$= \pm .67$$

which is the variation about a line representing the relationship between the two series.

Total variance is:

$$\sigma_Y^2 = \frac{\Sigma(Y-\bar{Y})^2}{N}$$

$$= \frac{82.10}{15}$$

$$= 5.4756$$

which is the entire variability about $\bar{X}$ and is measured by the square of the standard deviation, δy^2.

The standard deviation:

$$\sigma_Y = \sqrt{5.4756}$$

$$= 2.34 (100 \text{ Kwhrs})$$

The explained variance is that part of the total variability that is eliminated by the introduction of the second variable.

$$\sigma_{Yc}^2 = \frac{\Sigma(Yc-\bar{Y})}{N}$$

where Y_c is the estimated data of dependent variables.

In relative form the explained variance is expressed by the coefficient of determination. The symbol is r^2, and is a ratio of the explained variance and total variation, as follows:

$$r^2 = \frac{\sigma_{Yc}^2}{\sigma_Y^2}$$

or

$$r^2 = 1 - \frac{s_Y^2}{\sigma_Y^2}$$

$$= 1 - \frac{.4489}{5.4756}$$

$$= 1 - .082 = .918 \text{ or } 91.8\%$$

The coefficient of correlation is:

$$r = \sqrt{\frac{\sigma_{Yc}^2}{\sigma_Y^2}} \text{ or } \sqrt{r^2}$$

$$r = \sqrt{.918}$$

$$r = -.958$$

Although the relationship is good, the minus sign signifies an inverse relation because an increase in the value of X results in a corresponding decrease in the value of Y. Therefore, the line of regression slopes downward.

Unexplained Variance

The residual or errors of estimate is the difference between the actual Y values and the estimated Y_c values computed from the regression equation:

$$s_{Y\cdot}^2 = \frac{\Sigma(Y-Yc)^2}{N} = \frac{6.75}{15}$$

.4489 (100 Kwhrs)

In relative form, it is expressed by the coefficient of nondetermination, k^2. It would be the ratio of unexplained variance to the total variance:

$$k^2 = \frac{s_Y^2}{\sigma_Y^2}$$

The coefficient of correlation is a relative measure of the degree of association between the two series. The standard error of estimate may be used in the same manner as the standard deviation, that is, one standard error of estimate will include 68% of the cases when measured off, plus and minus, about the line of regression. Two standard errors of estimate will include 95% of the data.

Rank Correlation

The coefficient of rank correlation is of service for problems in which we have the actual X and Y values. It is also of service in those situations, which arise occasionally involving information only about the rankings of variables. Rank correlation is used for a quick preliminary survey of association, where no other way of assessing variation exists, and as a substitute for the Pearsonian formula because of its simplicity.

Correlation coefficient of ranks, usually designated by rho, is given by Spearman's formula:

$$\rho_s = \frac{1-6\Sigma D^2}{N(N^2-1)}$$

where D is the difference in ranks of each observation, and N is the number of cases. The use of this concept is explained below.

Substituting the values from tables IV and V gives:

$$\rho_s = \frac{1-6\Sigma D^2}{N(N^2-1)}$$

$$Ps = \frac{1-6(26.5)}{10(10^2-1)}$$

$$Ps = \frac{1-159.0}{990}$$

$Ps = 1-.16 = +.84$ Coefficient of rank between (1) and (2)

$$= \frac{1-6(24)}{10(10^2-1)}$$

$$= \frac{1-144}{990}$$

$Ps = 1-.145 = +.855$ coefficient of rank correlation between (1) and (3)

$Ps = 73.1\%$

In the above two cases, a high degree of correlation exists when test scores and sales, and experience and sales were associated separately, other variables being eliminated. In fact, there was a higher degree of correlation between experience and sales.

The rho squared figures indicate that one could expect that a 70% to 73% variation in sales would be associated with the variable test scores or experience in years respectively. Other causes accounted for the remaining 27 to 30 per cent variation in sales.

Sampling

Sampling occurs when you only take part of the whole. Probability sampling is based on the theory of probability. It is used because it is more accurate, saves time, decreases costs, and because of the possible destructable nature of a test.

Types of Sampling

Purposive or judgment sampling is not based on the theory of

Table IV Rank Correlation between (1) and (2)

	Test Score	Sales (0000$)	Rank of X	Rank of Y	Difference in Rank	
Salesman	X	Y	X′	Y′	D	D^2
1	5	6	7.5	7.5	0	0
2	4	6	9	7.5	1.5	2.25
3	6	5	5.5	9	−3.5	12 25
4	3	4	10	10	0	0
5	7	10	3.5	3	.5	.25
6	9	12	1	1	0	0
7	5	8	7.5	6	1.5	2.25
8	8	9	2	4.5	−2.5	6.25
9	6	9	5.5	4.5	1.0	1.00
10	7	11	3.5	2	1.5	2.25
						26.50

Table V Rank Correlation between (1) and (3)

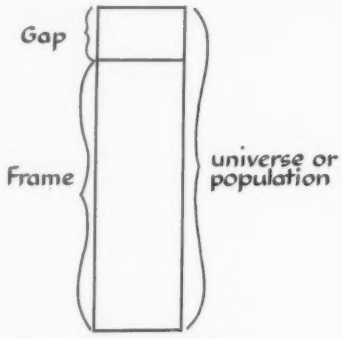
	Experience (in years)	Sales (0000 $)	Rank of X	Rank of Y	Difference in Rank	
Salesman	X	Y	X′	Y′	D	D^2
1	3	6	9.5	7.5	2.0	4.0
2	5	6	7.5	7.5	0	0
3	5	5	7.5	9	−1.5	2.25
4	3	4	9.5	10	−.5	.25
5	6	10	6	3	3	9
6	11	12	1	1	0	0
7	9	8	4	6	−2	4
8	8	9	5	4.5	.5	.25
9	10	9	2.5	4.5	−2	4
10	10	11	2.5	2	.5	.25
						24.00

probability. An example would be the Dow Jones Averages, in which the sample is selected by the interviewer.

Probability sampling means that every item in the population (total group of variables included in the study) has a chance of appearing in the sample, and each sampling unit is chosen at random. Unrestricted random sampling means that every item in the population has an equal chance of being included in the sampling. Restricted sampling shows the population as being broken down or stratified. However, each item in this universe has some chance of being chosen, although they may not be necessarily equal.

If you were required to pick out one county to represent the whole country for the study of unemployment, would you select the county by judgment or at random?[1] In this situation the county would be selected by judgment sampling because it would enable one to select a county which is "typical" of the population and use the data obtained as representative of the sample. Statistically, this "typical" element is a group sampling of one, with a value of characteristic x near the mean of the population. A random sample, where every element of the population has a chance of being selected would not be suitable for the purpose at hand.

1. Deming, W. Edwards, "some Theory of Sampling," page 23. John Wiley and Sons, 1950.



Parts of a Sampling Plan

1. The Frame is a list of sampling units as shown in the following diagram. The frame may consist of a map, a set of rules, a card file, etc. The decision on the gap (or whether the frame is adequate) is the responsibility of the person paying for the study. It is a question in subject matter, not for statistical theory. No sample of the frame will cover the gap. The universe may be the people or material you want to study. A sample can only give an estimate of what is in the frame. You may change your universe, but a frame remains fixed.
2. The procedure of selection;
3. The formula for the estimate; error;
4. The formula for the standard
5. Probe (or control) for evaluation of non-sampling errors.

A sample is valid when it has a standard error, and if its bias of the estimated procedure is known. A sample is efficient if it is valid and if it delivers much information per dollar. A small standard error means great precision, but, this does not mean great usefulness. When one studies causes, he has a standard error even in a complete count.

Theory of Probability

This is the mathematical chance of an event occurring. Empirical probability is based on past experience such as all types of insurance, sporting events, giving birth to twins, etc. A priori probability is based on the nature of the game or event and is illustrated by card games, dice, or coins.

The probability of an event occurring is expressed as $p = \frac{m}{m+n}$, where m are the number of ways an event will occur, and n are the number of ways the event will not occur. The probability of an event not occurring is indicated by $q = \frac{n}{m+n}$. When $p = 1$, the probability of its occurrence is certain; p can equal zero, in which case the event hasn't any chance of happening.

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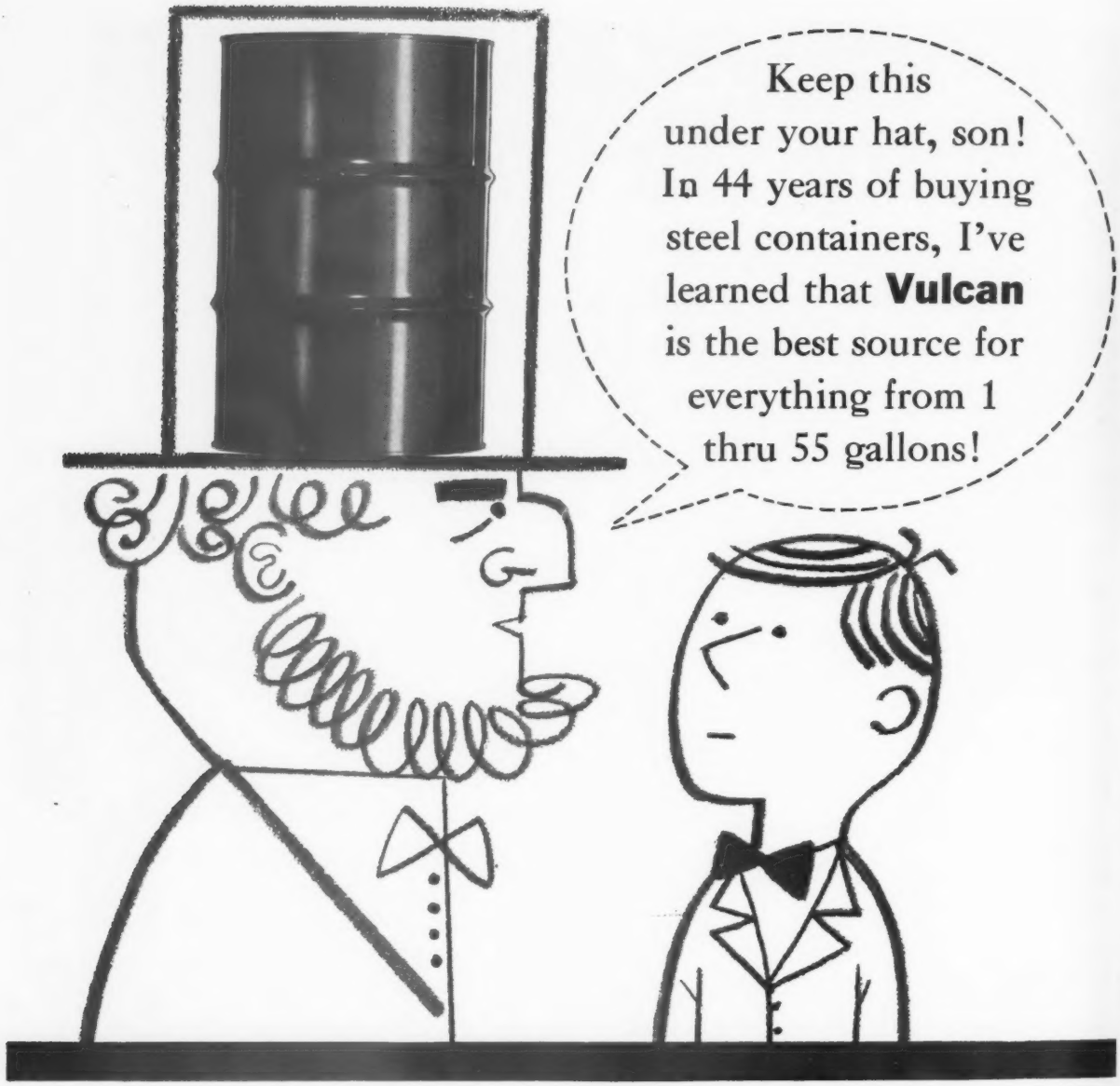

That lesson needn't take you more than a few minutes to learn and here's why: Vulcan makes a complete selection of quality steel containers under one roof; everything from 1 thru 55 gallons, with all the closures, styles and linings you could want. In decorator colors, too! This means that you can order all of your container needs *most economically* with a combination truck, car or trainload shipment from Vulcan. ★ More important to know is that Vulcan quality, convenience and service costs no more than ordinary steel containers. That's the lesson for the day! Why not let your experience prove it soon!

PVP-40

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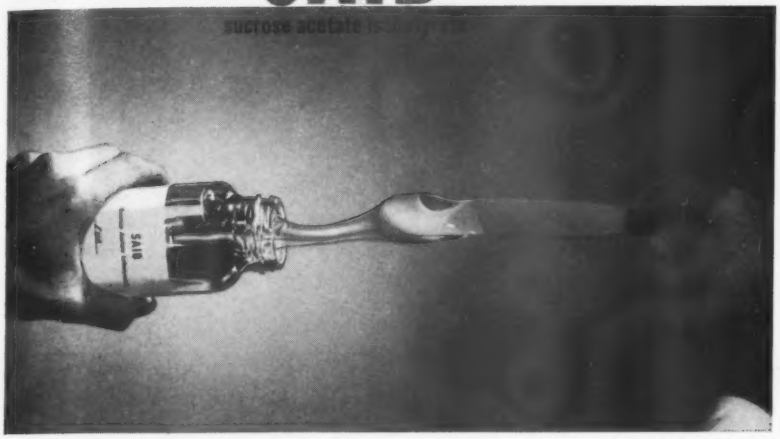
Unique function of SAIB aids lacquer formulators



SAIB has a molecular weight of 838. At room temperature, it is a semi-solid. Its color is exceptionally light and its color stability upon exposure to heat or ultraviolet light is excellent. (Heated to 175°C. for a period of 6 days, its color increases slowly to straw yellow, with no appreciable change occurring until after 24 hours of heat-aging.) SAIB is unaffected by contact with bronze powders. It is compatible with a wide variety of polymers, modifiers and plasticizers and is highly soluble in most common solvents. (A 90% solution of SAIB in ethyl alcohol has a viscosity of only 750 centipoises at 30°C.)

SAIB increases solids content

The high degree of compatibility exhibited by SAIB with virtually all major film-formers coupled with its exceptional solubility in common lacquer solvents *(see table below)* permits formulation of high-solids lacquers at practical application viscosities.

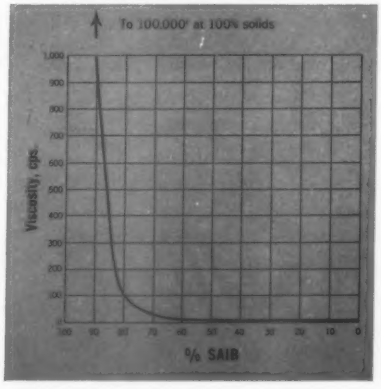
Viscosity of 50% SAIB Solutions
(Brookfield viscometer, 25°C.)

Solvent	*Viscosity, cps.*
Ethyl alcohol	8
Isopropyl alcohol	14
Ethyl acetate	8
n-Butyl acetate	9
Toluene	9
Hexane	6
Methyl ethyl ketone	6
Methyl isobutyl ketone	8
1-Nitropropane	11

SAIB improves film properties

One of the most significant characteristics of SAIB is its effect on film hardness at high modification. With nitrocellulose, for example, the Sward hardness of a 50% SAIB-modified film is increased from 65 to 78. Higher modification yields softer films. Cellulose acetate films also are increased in hardness upon addition of SAIB. In this case, however, maximum hardness occurs at a concentration of about 25%. With cellulosic films other than nitrocellulose and cellulose acetate, high modification produces only a slight decrease in hardness with no significant change in solution viscosity.

Viscosity of Solutions of SAIB in Ethyl Alcohol at 25°C.



Other film properties can often be improved. Plastic lacquers formulated with Half-Second Butyrate and SAIB, for example, show very good adhesion to Mylar polyester film and nylon. Such lacquers can also be made heat-sealable. Vinyl and acrylic solutions when modified with SAIB show improved sprayability and less tendency toward cobwebbing, with no significant change in viscosity.

Good flexibility in many SAIB-modified polymers can be achieved by including small amounts of Eastman polymeric plasticizer NP-10.

How does SAIB function in lacquer systems?

Note that the room-temperature viscosity of a solution of SAIB in ethyl alcohol remains below 10 centipoises up to 50% solids, increasing to only 100 centipoises at 80% solids *(see graph)*. At this point, however, the viscosity increases sharply to the 100,000+ level of pure SAIB. A similar relationship exists between SAIB and other common lacquer solvents.

At the highest conceivable concentration at which SAIB might be used to modify a lacquer system, therefore, its effect on application viscosity is negligible. Even after much of the solvent has evaporated from the film, SAIB does not hinder flow-out or leveling. While this phenomenon might also be observed with certain plasticizers, SAIB does not exhibit plasticizing properties, hence its very limited effect on the resulting film.

Because of its unique behavior, plus its low color, stability and reasonable cost, SAIB offers a new approach to lacquer formulation. It is supplied both as a 90% solution, designated *SAIB-90*, and in the undiluted form, designated *SAIB*. For a sample of SAIB, as well as a technical report on its physical properties and performance in coatings, write your nearest Eastman sales office or EASTMAN CHEMICAL PRODUCTS, INC., Chemicals Division, KINGSPORT, TENNESSEE.

SAIB
SUCROSE ACETATE ISOBUTYRATE

Eastman CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company

SALES OFFICES: Eastman Chemical Products, Inc., Kingsport, Tenn.; Atlanta; Chicago; Cincinnati; Cleveland; Detroit; Framingham, Mass.; Greensboro, N. C.; Houston; New York; Philadelphia; St. Louis. West Coast: Wilson Meyer Co., San Francisco; Los Angeles; Portland; Salt Lake City; Seattle.

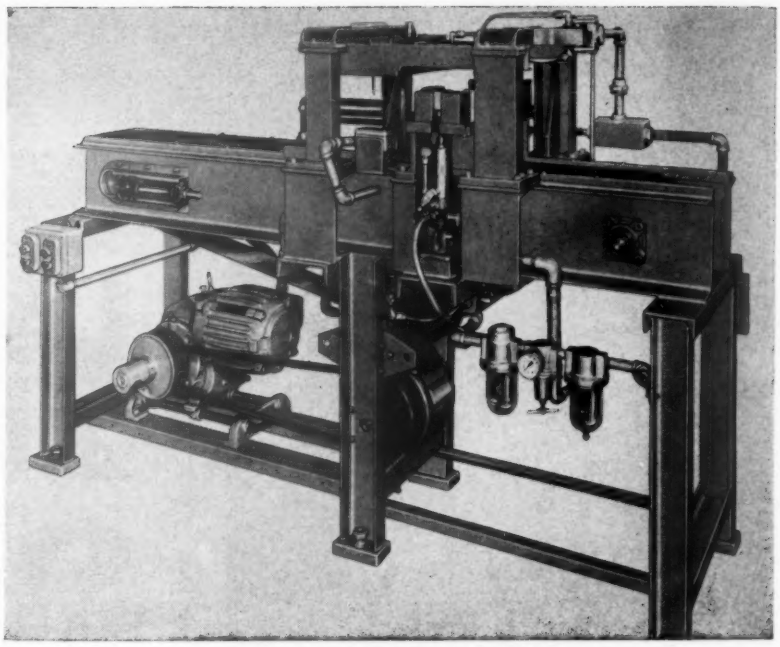
Continental Can Develops Bail Inserting Machine

Inserting preformed bails to the ears of filled one-gallon paint cans on the manufacturer's production line can now be accomplished at the rate of 25 cans per minute on a new semi-automatic machine which has been designed and built by the Equipment Development Dept. of Continental Can Co.

Known as the 475-BIM Bail Inserting Machine, the new design has change parts to handle the Pittsburgh style bail (both ends of bail point same direction) as well as the Chicago style bail (two ends of bail point opposite directions). The machine can also be equipped to handle either the soldered ear or the clinched ear can.

In operation of the 475-BIM, the single operator locates the preformed bails to the can ears by hand. The can and bail are placed on the conveyor where the can is automatically positioned with reference to the assembling jaws by registration on the ears of the can. The jaws insert the ends of the bail into the holes in the ears of the can.

The fact that the jaws of the machine are registered on the ears of the can is an important design characteristic. It eliminates difficulties which would otherwise occur when running cans feed at random, on which the ears are not all located the same distance from the end of the can. The machine is designed to handle the normal variations in cans from one supplier as well as the variations encountered in cans from several suppliers.



Continental Can's Bail Inserting Machine

The new machine is expected to be available for commercial production by the middle of 1960; and delivery can be anticipated 90 days after a firm order is placed. The price is $4,000, including one set of change parts for the Pittsburgh or Chicago type bail and one set of change parts for the soldered or clinched ear, plus a gear head electric drive motor.

Conforming Matrix Announces Special Conveyor Machine

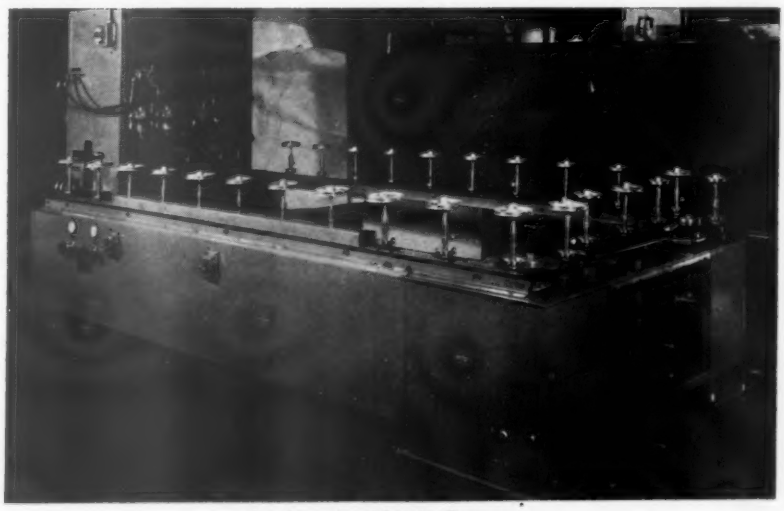
A special machine which adapts the chain-on-edge principle to automatic spray finishing has just been announced by the Conforming Matrix Corp., Toledo, Ohio.

One version of the machine, is tailored to fill the needs of a producer of pulleys, but that purpose is but one of many which can be fitted to the customer's requirements.

The machine is equipped to handle necessary spray guns for painting from above and beneath, either or both, continuous or skip spray. Any number of workholders from a minimum of 15 can be supplied on centers to suit size of part, loading and drying time. The conveyor is constructed of sturdy channel angle and sheet steel. The chain employed is rigid roller or conveyor chain.

The machine is equipped with a variable speed drive on the conveyor and can be equipped with variable speed drive to revolve the piece part.

A convenient electric safety stop or control button, air filter and automatic valve lubrication is also provided along with proper exhaust capacity to match the job requirements. Bake ovens, heat lamps, gas off and cool off tunnels can also be furnished.



Conforming Matrix Conveyor

AZO Leaded ZINC OXIDES

meet exact requirements of paint industry

Paint manufacturers in increasing numbers are using economical leaded zinc oxides in their exterior paints. To meet this growing demand, a number of AZO leaded zinc oxides have been developed, and are immediately available.

In addition, we are prepared to produce oxides of any lead content and consistency to meet the requirements of special formulas. You can be sure of the right leaded zinc oxide for your product when you specify AZO.

CO-FUMED TYPE LEADED ZINC OXIDES

AZO 35-L. 35% leaded zinc oxide of low consistency.

AZO 50-L. 50% leaded zinc, low consistency.

AZO 18-L. Highly basic, low consistency type.

All co-fumed leaded zinc oxides are easily mixed and incorporated in paint vehicles.

BLENDED TYPE LEADED ZINC OXIDES

AZO 20-B. Acicular type of 20% leaded zinc oxide. Excellent color, medium consistency.

AZO 35-M. Acicular type of 35% leaded zinc oxide. Excellent color, medium consistency.

Blended type leaded zinc oxides generally give higher consistency (or oil absorption) and improve the color of the product.

American Zinc sales company

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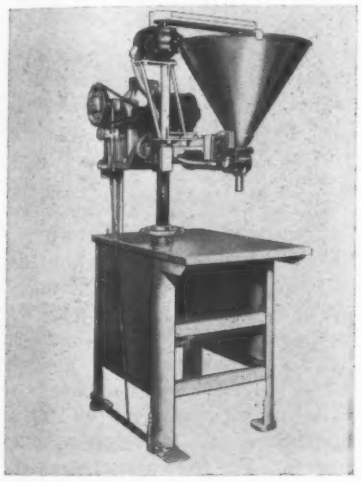
NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



ELGIN

HAND FILLER
Reservoir or Manifold Feed

New, compact hand filler easily adapted to a broad range of liquid or viscous products and ideal for "Boil-in-Bag" filling has just been introduced.

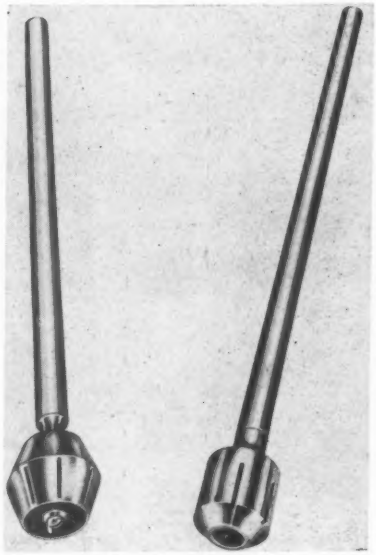
An adaptation of the automatic "Single Valve Filler," the machine represents the company's entry into the manufacture of hand feed equipment specifically designed to meet today's increasing number of special filling needs.

Featuring single revolution clutch, the unit is precision designed for faultless delivery of products in the food, paint, cosmetic and oil industries. Covering a large range of container sizes up to 32 ounces, it can also be equipped with special size cylinders and pistons for larger or smaller capacities.

Plants with low or moderate production or frequent change-over of products will find this new machine particularly versatile. Quick and easy to clean, the unit is perfect where a variety of products and different sizes and shapes of containers must be used, he said.

Occupying minimum floor space of only 24 x 36 inches, the machine is available with a reservoir or manifold feed. An agitator can be inserted in the reservoir for products that require it.

Elgin Manufacturing Co., Dept. PVP, 200 Brook St., Elgin, Ill.



PREMIER MILL

MIXERS
Micro-Shear Head

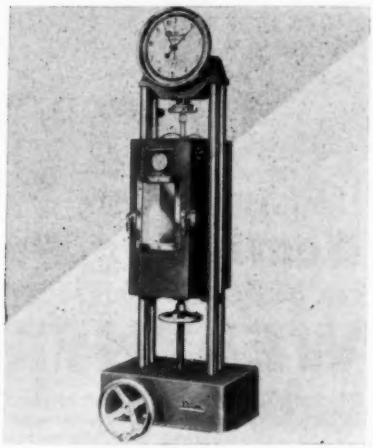
New high speed mixers, the Dispersators, are featuring a new head offering high intensity shearing and dispersion. Available in both simplex and duplex versions, the new head has been termed "Micro'-Shear." Premier Mill Corp., Dept. PVP, 224 Fifth Ave., New York 1, N. Y.

TESTING CABINET
Increased Sidewall Thickness

A useful accessory for a well-known line of universal testing machines has been announced. The controlled-temperature cabinet has undergone several important changes that make it more adaptable to a variety of operating conditions.

To provide a more uniform temperature, sidewall thickness has been increased, and a positive interlock is now employed at all seams or joints. Electric heating element surface has been increased so that there is less waiting time for temperature level. The new improved thermostat regulates heat to close degree. The new larger size observation window gives the operator a clear view of the specimen under test.

The Model L tester has a 20" daylight opening. Controlled temperature cabinets will also fit 30" and 40" daylight opening models. Specimens are inserted in grips inside of cabinet in normal manner and can be checked in tensile, compression, transverse or shear. The Model L instrument will apply test loads from as low as 0-250 pounds, and as high as 0-10,000 pounds. It is available either as a hand-operated or motorized unit. Dynamometer gauges are offered with 5" or 10" diameter dials and are readily interchangeable as to capacity. Installation of the con-



W. C. DILLON

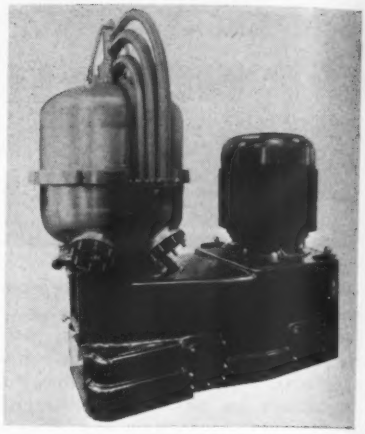
trolled temperature cabinet requires approximately four or five minutes, thus making it a simple matter to check materials at elevated temperatures. Working range is from room temperature up to 400°F. on standard cabinet.

George A. Dillon, c/o W. C. Dillon & Co., Inc., Dept. PVP, 14620 Keswick St., Van Nuys, Calif.

NOZZLE-BOWL CENTRIFUGE
Adjustable Motor Base Plate

New nozzle-bowl centrifuge for high pressure and high temperature operation, has been introduced. Designated the QX-312, this centrifuge may be used as a solids concentrator, liquid clarifier or solid particle classifier. This unit can handle up to 450 gpm at temperatures to 300°F. and pressures to 125 psi.

The bowl covers meet standard pressure vessel requirements, and necessary connections on the top and bottom cover are pressure-tight to allow continuous high pressure operation. Top cover connections are for feed, effluent discharge and recirculation (if required). Bottom connections are for the nozzle discharge and vent for the nozzle discharge. Clarified



DELAVAL

effluent is discharged by means of a paring device which functions at a pressure differential up to 50 psi over the operating pressure. Solids discharged from nozzles flow by gravity from the vented sludge port.

The bowl spindle is driven by a direct V-belt drive. The motor and spindle are enclosed in a compact frame for floor mounting. The standard vertical flange motor operates at 1750 rpm and is mounted on an adjustable motor base plate. The motor develops 40-100 hp depending on the material flow through the unit and the pressure requirements. For pressure operation a shaft seal is provided on the bowl spindle directly above the driving mechanism.

The De Laval Separator Co., Industrial Div., Dept. PVP, Poughkeepsie, N. Y.

DUST COLLECTOR
Fire-resistant

A compact, low-cost industrial dust collector suitable for use in any light dust-producing operation is being produced by Torit Manufacturing Co., manufacturer of dust collectors and associated equipment.

The new model 301 stands only 21½″ high and occupies a space 12″ x 14″. Because of its small size, it can be conveniently located on or under work benches. The new collector, is said to be particularly suited to dust control in electronic and other precision production as well as to any light or occasional manufacturing operation producing dust.

The dust-collecting medium in the model 301 is a highly efficient,

fire-resistant, throwaway glass filter. Performance ratings under standard test conditions are: 200 cfm; velocity, 4100; static pressure, 1.7" w.g.; inlet, 3". The 301 is equipped with a 1/3 hp motor.

Torit Manufacturing Co., Dept. PVP, 1133 Rankin St., St. Paul, Minn.

LABLINE

TEST CABINET
All Steel Finish

New environmental test cabinet with special "add-on" facilities for altitude, vacuum, humidity and temperature testing has been developed.

The universal unit was designed specifically to answer the needs of laboratories with expanding environmental test requirements.

The "Com-pac Cab," as it is called, was designed specifically for effective low temperature operation with an adjustable temperature range from 300°F. to −120°F. It functions with complete dependability for varied testing by merely adding optional equipment. The working chamber is 19" x 19" x 19". It is electrically welded and resistant to high pressures.

Construction features include a sturdy, galvanealed, all-steel finish. It also has a frostproof, multipane door in front for easy access to the chamber area, which is illuminated by a 40-watt Lumiline fluorescent lamp.

The unit has a sealed-in oil supply and a built-in thermal overload protector. Overall dimensions are 74" x 32" x 32", which allows easy, compact installation. It is electrically powered by a 230 volt, 60 cycle, single phase motor. It may be ordered as a horizontal or vertical free-standing floor unit or for bench use.

Hudson Bay Co., Division of Labline, Inc., Dept. PVP, 3070-82 W. Grand Ave., Chicago 22, Ill.

VINYL DISPERSION RESIN
Low Viscosity

The development and availability of PVC 70, a new vinyl dispersion resin for organosols and plastisols has been announced.

Considered one of the most thoroughly pretested dispersion resins ever put on the market, PVC 70 is said to allow the formulation of dispersion compounds with several distinct advantages over conventional compounds: low viscosity at both low and high shear rates as well as excellent viscosity stability.

According to the manufacturer, over a million pounds of PVC 70 were produced at the firm's new facilities in Houston, Tex., to test and prove its superior uniformity in quality and performance. PVC 70 is now being used extensively by

plastic processors in production runs throughout the country.

Diamond Alkali Co., Plastics Div., Dept. PVP, 300 Union Commerce Bldg., Cleveland 14, Ohio.

GLASS DIAPHRAGM VALVES
Corrosion Resistant

"Solidex" valves of high quality borosilicate glass with a Teflon diaphragm are available.

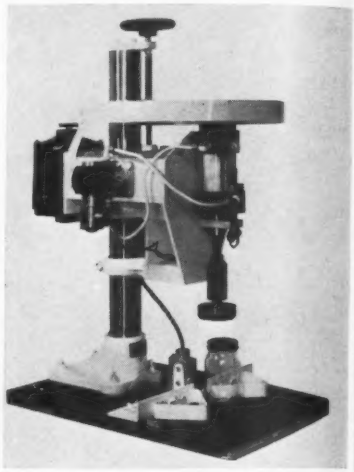
The rugged, corrosion resistant, easy to service glass valves are made in both angle and straight through models to fit 1", 1½" and 2" glass pipe. They are effective from a vacuum of 10 mm. of mercury to a positive pressure of 30 p.s.i.g.

The high quality borosilicate glass is annealed to withstand 200°F. instantaneous thermal shock and 400°F. operating temperature.

Liquids flowing through the valve can come in contact with only two materials—the glass body and the Teflon diaphragm. Flow is controlled by the movement of the diaphragm in relation to its ground glass seat.

Solidex valves are recommended for use in glass laboratory, pilot plant and production installations and provide a simple, versatile, inexpensive way to control the flow of all liquids except hydrofluoric acid and hot alkalies.

Porter Engineering Co., Dept. PVP, 1513 W. Orvilla Rd., Hatfield, Pa.



SCIENTIFIC FILTER

SCREW CAPPER
Electronically Controlled

A completely new type of air operated screw capper, Model "CEC" for all sizes and types of caps and containers, even soft polyethylene bottles, has been announced.

Automatic electronic controls govern the entire capping cycle. This eliminates an average of about 1500 to 3000 hourly motions per operator. Aside from increased output there is also a consequent reduction in operator fatigue.

The "Whirlwind" is equipped with a special control valve which cushions the descent of the capping head thus preventing damage or breakage in event container is incorrectly positioned. This "cushioned" capping head is ideal where plastic or fragile containers are being handled.

Scientific Filter Co., Dept. PVP, 57 Rose St., New York 38, N. Y.

LOAD GRAB
Grips 2 or 4 drums

New side shift load grab with grip-o-lift arms is now available.

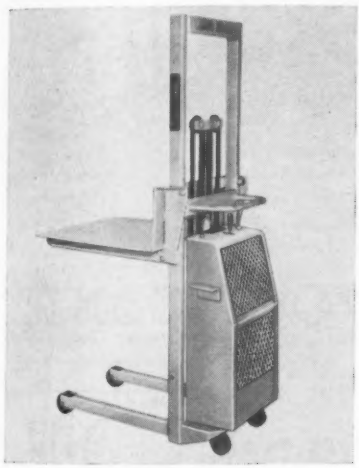
The Spacemaster Model "J" equipped with a cascade side shift load grab and little giant grip-o-lift arms can handle unit loads with or without pallets. In the clamping position they grip two or four drums, heavy cartons, or bales.

NEW MATERIALS — EQUIPMENT

By lifting the pin, the arms lay flat and can be used as forks to handle pallets. With the side shift load grab exact positioning of loads can be obtained.

Gripping surface is hard, smooth rubber bonded to steel sheets screwed to ¼" steel plates. These sheets can be quickly removed and replaced in a few minutes.

Lewis-Shepard Products, Inc., Dept. PVP-R9-34, 125 Walnut St., Watertown 72, Mass.



LANGLEY

PORTABLE LIFTER
Light Machine Weight

New low priced compact battery powered portable lifter "Little Dickie" enables an operator to lift, transport and position loads weighing up to 1000 pounds. The platform 26" by 28" travels from 4½" above the floor to 64" at 20 Fpm.

Lifting power is supplied by a unitized battery hydraulic unit with a built-in overnight charger. Double lifting chains and special rollers to handle side thrust platform loads provides safety. It has great mobility because of a combination of anti-friction bearing wheels, light machine weight and compactness.

The model BHD "Little Dickie" complete with battery and charger weighs only 330 pounds and will pass through a 78" door.

Langley Manufacturing Co. Inc., Dept. PVP, 913 Cambridge St., Cambridge 41, Mass.

Weatherproof your paint with **Minnesota** Linseed Oil!

Beware the weathering action of ordinary rain. Water can soak the surface of your exterior house paint and leave it soft—vulnerable to excess oxidation. The next rain will wash away the powdery film and start the attack all over again. But oil is the enemy of water. The destructive cycle that is so fast in inferior paints can be retarded with linseed oil. In most of the best paints, a Minnesota Linseed Oil base is used as a safeguard from all weathering agents. Minnesota, the quality brand linseed oil, is the time-proven way to superior protection. Call our nearest representative today . . . your paint will show the difference.

SINCE 1870

OUR 90th YEAR

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LINSEED OIL CO.

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SPECIFY MINNESOTA ★ IT'S PURE! ★ LINSEED OIL

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PHILADELPHIA, PA.
E. W. Kaufmann
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Flourtown, Pa.

DAYTON, OHIO
The Dayton Oil Co.
1201 East Monument Ave.

DETROIT, MICH.
Baker & Collinson
12000 Mt. Elliott Ave.

LOS ANGELES, CALIF.
Stay & Day Paint
Materials Co.
363 South Mission Road

LOUISVILLE KY.
H. H. Benner Co.
803 Hoffman Bldg.

PITTSBURGH, PA.
Joseph A. Burns & Son
124 Harrison Ave.

SAN FRANCISCO, CAL.
Wm. C. Loughlin Co.
311 California St.

SEATTLE, WASH.
W. Ronald Benson, Inc.
820 1st Ave. So.

ST. LOUIS, MO.
Ivan T. Bauman Co.
817 North 2nd Street

PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries $1.00 per copy) to the publisher.

Epoxy Resin

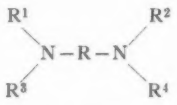
U. S. Patent 2,291,049. Harold L. Moroson, Elizabeth, N. J., assignor to Reichhold Chemicals, Inc., Detroit, Mich.

A process of producing a liquid epoxy resin which comprises initially reacting diphenylolpropane and epichlorohydrin in the proportion of 2 to 3 moles of epichlorohydrin to 1 mole of diphenylolpropane under alkaline conditions at a temperature within the approximate range of 40 to 70°C. to produce a resin intermediate, thereafter adding to the resinous reaction mixture from 10 to 25% of its weight of epichlorohydrin and then azeotropically stripping the resinous intermediate to produce a final liquid resin of desired viscosity with substantially complete recovery of the added epichlorohydrin.

Vinylidene Polymer Composition

U. S. Patent 2,922,770. Myron A. Coler, Scarsdale & Arnold S. Louis, Riverdale, N. Y.

A composition of matter comprising a polymer of a vinylidene monomer and containing a destaticizing additive consisting of from 1% to 50% by weight, based on the weight of the polymer, of an ammonium salt produced by reacting (1) a totally hydroxyalkylated amine of the formula



in which R is an alkylene radical containing from 2 to 6 carbon atoms and R_1, R_2, R_3, and R_4 are hydroxyalkyl radicals with from 2 to 8 carbon atoms with (2) and acid, the proportion of acid to diamine being such that a hydrogen attaches to at least one and not more than both nitrogen atoms of the diamine; and the resulting compound having a vapor pressure of less than 760 mm. at 225°C.

Production of Anti-Corrosive Coatings for Metals

U. S. Patent 2,923,643. Robert Hunter Rodwell, London, England, assignor to Hunter & Co. Limited, London, England.

In the process of producing an anticorrosive coating on metals which comprises applying to the metal surface at least one coating of an aqueous suspension of a hydratable cement, said suspension of a hydratable cement, said suspension containing zinc chromate of the order of 3%, the improvement comprising incorporating in the suspension polyvinyl acetate of the order of 2% of the water employed in the slurry, allowing the coating to dry and applying to the dried coating at least one coating selected from the group consisting of bitumen and synthetic resin in a solvent vehicle.

Blends of Urea-Formaldehyde Resins

U. S. Patent 2,923,644. William F. Jerves, Bridgewater Township. Somerset County N. J., assignor to American Cyanamid Co., N. Y., a corp. of N. Y.

A stable, hydrophilic, potentially thermosetting resinous product comprising a physical blend of a partially polymerized, partially alkylated, water-soluble urea-aldehyde condensate and a partially polymerized, water-soluble bisulfite-modified thiourea-formaldehyde condensate containing in 100 parts by weight of the blend 55 to 88 parts of the former and 45 to 20 parts of the latter, said alkylated urea-aldehyde component being prepared by reacting

in aqueous medium relative proportions of 1.50 to 2.25 moles of a water-soluble aliphatic aldehyde with 1 mole of urea at a pH of from 7.0 to 10.0 and at a temperature of from 70 to 100°C. for from .25 to 2.0 hours, adjusting the pH of the reaction mixture to a pH of between 4.0 and 6.0, and reacting said urea-aldehyde condensate at a temperature of 70 to 100°C. for from .25 to 2.0 hours, with 0.3 to 2.0 moles of an aliphatic alcohol containing from 1 to 3 carbon atoms, and thereafter neutralizing the reaction mixture, said bisulfite-modified thiourea component being prepared by reacting in aqueous medium relative proportions of 0.4 to 1.4 moles of formaldehyde, .01 to .06 mole of a material selected from the group consisting of water-soluble bisulfite and sulfites capable of yielding such bisulfite under the conditions to be described and 1 mole of thiourea, at a pH range of from 7.0 to 10.0 and a temperature of from between 50 and 100°C. for from 1 to 30 minutes, and thereafter blending these respective components in the weight ratio set forth above.

Modified Phenolic Resin

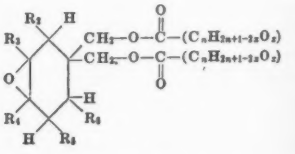
U. S. Patent 2,926,149. Frank Backer, North Bergen, N. J. assignor to Allied Chemical Corp., a corp. of N. Y.

A process for the production of non-heat-reactive para - α - cumylphenol - para - substituted - phenolformaldehyde resin having outstanding chemical and physical characteristics adapted particularly for special surface coatings which comprises heating a mixture of para-.-cumylphenol and a para-substituted-phenol selected from the group consisting of a para-alkyl-substituted-phenol wherein the alkyl group has 3-10 inclusive carbon atoms and 2,2'-bis-(dihydroxy diphenyl)-propane and mixtures thereof in a molar ratio of 0.33:0.67 to 0.90:0.10 of para-α-cumylphenol to para-substituted-phenol together with formaldehyde in the molar proportion of 1.0-1.5 mols of formaldehyde per mol of total phenol, i.e. total mols of para-α-cumylphenol and para-substituted-phenol, in the presence of an acid catalyst at a temperature within the range of about 75-250°C. to effect reaction of the phenols and formaldehyde.

Vinyl Stabilized With Epoxy Compounds

U. S. Patent 2,294,583. Paul S. Starcher, Charleston, Samuel W. Tinsley, South Charleston & Dennis H. Mullins, St. Albans, W. Va., assignors to Union Carbide Corp. a corp. of N. Y.

A vinyl chloride composition comprising a vinyl chloride resin containing epoxidized diesters of 3-cyclohexene-1,1-dimethanols characterized by the formula:



wherein R_2 through R_6 represent members selected from the group consisting of hydrogen atoms and lower alkyl groups and the group $(C_nH_{2n+1-2x}O_x)$ represents an epoxyalkyl group containing n carbon atoms, $2n+1-2x$ hydrogen atoms and x oxygen atoms wherein n represents the integer 17 and x represents a whole positive integer in the range of from 2 through 3.

Resinous Flameproofing Composition

U. S. Patent 2,924,532. John E. Dereich. Painesville, Ohio, assignor to Diamond Alkali Co., Cleveland, Ohio, a corp. of Delaware.

A flameproofed composition consisting essentially of a transparent, organic, high polymeric plastic material selected from the group consisting of polyester resins, polyethylene, cellulose acetate butyrate and polystyrene combined with 10-65% by weight of a composition consisting essentially of 50-96% by weight of a chlorinated aliphatic hydrocarbon containing 50-80% by weight of chemically combined chlorine and having 18 to 36 carbon atoms and 4-50% by weight of an aliphatic antimonyl compound selected from the group consisting of potassium antimonyl tartrate, ammonium antimonyl tartrate, barium antimonyl tartrate, ethylenediamine antimonyl tartrate and antimonyl catechol.

100% ACRYLIC

Brighter future for exterior wood surfaces

Looking for an emulsion paint vehicle that will hold up on outdoor wood surfaces? RHOPLEX AC-33 100%-acrylic emulsion is your answer. Extensive outdoor tests have shown that RHOPLEX AC-33 paint films applied to suitably primed wood have good resistance to blistering, yellowing, cracking, and degradation by ultraviolet light, chemical fumes, and salt spray. And that isn't all; RHOPLEX AC-33 takes the drudgery out of house painting. RHOPLEX AC-33 paints spread like a dream—no brush drag, even in warm weather. Fast drying allows the application of a second coat one hour after the first. One scaffold setting takes care of both coats. There is less work in cleaning up, too—just wash your brushes with soap and water.

RHOPLEX AC-33 paint films remain flexible and stretchable—even after years of exposure to sunlight and weather. Thus, they can match the expansion and contraction of wood exposed to varying weather conditions. And since RHOPLEX films are permeable to vapor, they allow trapped indoor moisture to escape, without letting in water from the outside. This helps to prevent blister formation. And speaking of moisture, RHOPLEX paints can be applied safely to damp surfaces—raindrops or dew on a thoroughly dried primer present no problem. Write today for Progress Report No. 6, a 54-page booklet giving formulating information, and 6-year exposure data for wood test panels and homes painted with RHOPLEX AC-33 paints.

RHOPLEX *is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.*

Chemicals for Industry

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

TECHNICAL Bulletins

FILTER CARTRIDGE

New color brochure is available on new filter cartridge.

Cartridge is manufactured of virgin synthetic fibers of selected denier and constructed to give consistent cartridge density and absolute control throughout the micron range. Unique construction of the cartridge, which can be engineered to customer specifications, is said to give increased solids capacity, lower pressure drop, more uniform performance, and up to six times the life of conventional filter cartridges.

The brochure explains the principles of the filter, illustrates it and explains the special distribution policy of direct selling and servicing.

American Felt Co., Dept. PVP, 2 Glenville Rd., Glenville, Conn.

EPOXY RESINS

Three new and different epoxy resins, displaying novel structure, reactivity and curing characteristics, are described in a new 24-page booklet.

The new epoxy resins are distinguished by their ability to peroxide cure through reactive double bonds as well as to cross link through conventional epoxy curing agents.

These materials can be formulated for a wide range of superior properties and often offer attractive production economies, according to the new brochure. Cure systems are thoroughly described by means of actual formulas used to obtain a variety of end properties. Thirteen different tables are used to present the physical and mechanical properties of the cured and uncured resins while ten graphs illustrate such properties as high heat distortion points, exotherm and molecular structure.

The epoxy resins are available in development quantities for evaluation. The data booklet will provide the necessary technical information for correct economic handling of these new and different materials.

Epoxy Department, Food Machinery and Chemical Corp., Dept. PVP, 161 East 42nd St., New York, N. Y.

LIFT TRUCK

All-new fork lift truck called the "Naro-Aisle-Stack" Model 590 that "reclaims" lost warehouse space, expands warehouse capacity up to 50 per cent through better utilization of existing storage space, is described in a colorful 18-page booklet.

Secret of the Model 590's tremendous space-saving advantages lies in exclusive engineering advances which enable the new-style lift truck to operate efficiently in 6 ft. aisles—4 to 6 ft. narrower than those required by conventional lift trucks.

Illustrated step-by-step are the lift truck's 180-degree pivoting action; plus its outstanding control features and components. Demonstrated graphically is a typical space-saving situation where 16 "extra" rows of storage space are gained by use of the Model 590 in a 200 x 400 ft. warehouse.

Differential action is achieved hydraulically by two specially designed variable displacement motors which transmit torque individually to each drive wheel.

Towmotor Corp., Dept. PVP, Cleveland 10, Ohio.

CABLE CONVEYOR

New, engineering design features, said to make the "Streamliner" overhead cable conveyor the smoothest running, easiest-to-install and maintain overhead cable conveyor system available are illustrated and described in a recently-issued, two-color, four-page folder. Interchangeable stock assemblies plus available accessories permit the installation of a custom-designed cable conveyor system to the user's special requirements at minimum cost.

Descriptions and illustrations in the catalog, include: improved segmented sheaves in the drive units and idler turns and specially designed driving lugs which are said to produce the smoothest operation; idler wheel turns available in 90° and 180° turns; rapid dip vertical idler turns for the most efficient rapid dip into and out of paint or cleaning tanks; prefabricated vertical "S" curves described as small radius, vertical track turns with sharply rising inclines and prefabricated horizontal track "S" Curves for use when offset angles are 45° or less.

Harry J. Ferguson Co., Dept. PVP, Jenkintown, Pa.

RESIN PAINT BASE

Thirty-page technical report describes the characteristics, compounding procedures, and applications of a new resin paint base.

This thermoplastic resin is a tough, lacquer-type paint vehicle.

Paints made with the new resin provide durable coatings with high resistance to acids, alkalis, and oils. The coatings also have excellent resistance to water vapor and are odorless, tasteless, and nontoxic.

The new report details the physical properties, chemical resistance, and solubility of the resin, and its compatibility with drying oils and resins.

The report also includes:

1. Detailed procedures for compounding paints with Marbon resins and for painting by brush or spray.
2. Interior and exterior uses for paints made with the resin.
3. A "trouble-shooting" chart giving solutions to production problems.
4. A comparison of the durability on steel of styrene copolymer resins with that of other common film formers.
5. A list of distributors.

Marbon Chemical Div., Borg-Warner Corp., Dept. PVP, Washington, W. Va.

HANDLING EQUIPMENT

How a leading manufacturer of meters, feeders and controls combined a remodelled stock room with new materials handling equipment to develop a unique method of handling 23,000 different items by storing 16 feet high in aisles only 5½ feet wide plus gaining 32,000 cubic feet of stockroom space, is the subject of a new case history bulletin.

The two-color, four-page presentation is fully illustrated with action shots taken at the manufacturer's plant. All phases of the operation are described in the text and illustrated.

Lewis-Shepard Products, Inc., Dept. PVP—RIO-4, 125 Walnut St., Watertown, Mass.

VOLUME PUMPS

Data Sheet D-59-1 explains how controlled volume pumps solved the problem of metering a softening agent into the distribution lines at the two pumping stations serving Ft. Bliss, Texas. By incorporating an automatic stroke length adjustment which responds to

changes in flow rates, the manufacturers of the pump ensure a consistent ratio of phosphate to water with varying water pumping rates —automatically and economically.

Milton Roy Co., Dept. PVP, 1300 E. Mermaid Lane, Philadelphia 18, Pa.

CARBON BLACKS

New 16-page booklet titled *Carbon Blacks for Paint*, describes the use of carbon black pigments in the protective and decorative coatings industry, and provides general information on how to select and disperse the proper carbon black grade for a particular application.

Carbon black characteristics by group, as well as individual black differences as to properties and usage are described. A chart shows typical properties for all paint blacks, and a section is devoted to packaging details.

Dispersion, particle diameter, surface characteristics and apparent density are discussed in relation to their effects upon color properties and paint systems.

Special Blacks Div., Godfrey L. Cabot, Inc., Dept. PVP, 125 High St., Boston 10, Mass.

VALVES

Valves for fluid flow and condition control are covered in a new eight-page booklet just issued.

Introductory material details such design and selection factors as function, application, and method of actuation.

Subsequent pages give engineering data, characteristics, range specifications, and illustrations of various types of valves: bypass, relief, check, regulator, shutoff, measuring, sequence, and special purpose.

Office of Technical Publications, United Aircraft Products, Inc., Dept. PVP, 1116 Bolander Ave., Dayton 8, Ohio.

MATERIALS HANDLING

How a leading book publisher coincided new warehouse planning with new materials handling techniques for a faster and more economical operation and gained 50 percent storage area, is the subject of a new case history bulletin.

The two-color, four-page presentation is fully illustrated with action shots taken at the manufacturer's plant. All phases of the operation are described in the text and illustrated by photos.

Lewis-Shepard Products, Inc., Dept. PVP RIO-5, 125 Walnut St., Watertown, Mass.

LABELING LAWS

Revision No. 1 of *Compilation of Labeling Laws and Regulations for Hazardous Substances* has just been published. The 25-page addition to the original copy contains new laws and regulations to September, 1959. Copies are $3.00. Complete copies, including the basic copy and Revision No. 1, are $7.00.

Chemical Specialties Manufacturers Assn., Dept. PVP, 50 E. 41st St., New York 17, N. Y.

SURFACE ACTIVE AGENTS

New 24-page catalog of surface active agents has been published.

Each product is described by trade name, active ingredient, percent activity, physical state, general use, specific applications and properties.

The products are divided into three general classes: anionic, cationic and non-ionic. There is a two-page section explaining the chemistry of each of these groups.

Onyx Oil & Chemical Co., Dept. PVP, Jersey City, N. J.

New Books

Analysis of Monomers and Polymer Materials
Part 1

Interscience Publishers, New York. 684 pages. $16.50.

Progress in the science and technology of high polymers has been closely linked to the development of modern methods of chemical analysis suitable for the unravelling of the complex compositions and structures of macromolecules. Many analytical procedures used for this purpose are described in research reports scattered through the literature in the many industrial fields in which resins and rubbers are used—the plastics, textile, paper, adhesives, and protective coatings industries, to name the largest—and often procedures for inspection and control are to be found only in company specifications or laboratory manuals of very limited distribution.

Analytical Chemistry of Polymers, the twelfth volume in the well-established High Polymers series, brings together in book form the first available collection of the analytical methods which have proved useful to research and control chemists in the testing of commercial monomers and polymers. Each of the authors contributing chapters in the book is an expert engaged in industrial research in his specialized field of macromolecular chemistry, and often includes in his contribution the details of methods used in the internal operations of his firm.

Part I, the present volume, describes methods for the assay and determination of pertinent impurities in monomers, followed by a discussion of analytical problems involved in the identification and characterization of the chemical composition and physical properties of polymers. Special chapters deal with the identification and analysis of plasticizers, ion exchange resins, textile fibers, natural and synthetic rubbers, protein polymers, natural resins, and drying oils; the scope and limitations of the methods are also discussed. Procedural details are given in the case of previously unpublished tests or well known tests which have been modified for the requirements of a particular analysis; otherwise, the analyst is referred to the original literature for detailed directions after the principal features of the method and equipment have been presented.

Part II, now in preparation, will deal broadly with molecular structure determination, chemical group analysis, and identification procedures for polymers. Emphasis will be placed on the theoretical background of each technique, specific problems in adapting the technique to polymer analysis, description of equipment and general procedure, and a systematic presentation of the available data which have been obtained by the use of each technique in the analysis of polymers.

Symposium on Particle Size Measurement

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 308 pages. Price $6.25.

This symposium contains in addition to its 18 papers a list of ASTM standards pertaining to particle size measurement. Many aspects of this kind of measurement are discussed, including sieves, mechanical methods of separation, electronic methods of measuring, and photo electric procedures.

The importance of particle size measurement has increased tremendously over the years. Engineers and scientists concerned with chemicals, paint, petroleum refining, rubber, metals, soaps, concrete, and powdered insulation, to mention a few, have found that particle size plays an important role in the physical and chemical properties of these materials. Considerations of the chemical reactivity, the ability to emulsify and the stabilization of quality control have defined a definite need for accurate, rapid, and economic methods of determination. This symposium presents current thinking in the field of particle size measurement.

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AEROSOL COATINGS

PACKAGING

FORMULATION

PRODUCTION

Spra-Lok Corporation, a subsidiary of Dupli-Color Products Co., Inc. recently announced the development of a mechanical locking device which can be incorporated in all types of aerosol cover-caps. The purpose of this locking device is to prevent accidental or intentional spraying of the contents at the point of sale. A silver foil label covers an opening in each cap where any key may be inserted to unlock the cap. An unbroken seal assures the customer that he is receiving a full measure of paint.

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HEAT RESISTANT to 1200 deg. F., a low-cost, high-temperature silicone-aluminum paint using UNION CARBIDE R-64 Silicone has protected this exhaust stack for six months. And the stack is still like new.

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UNION CARBIDE SILICONES

AEROSOL PAINT CANS

An evaluation of aerosol containers for packaging paint products with some thoughts on the new giant aluminum types.

By
E. G. Roberts

RECENTLY an aerosol filler stated that the industry now has 75 different types and shapes of container to choose from, and predicted 150 by 1965, whereas there were only two stock cans 10 years ago.

This greater selection of containers has been an important factor in the growth of aerosols and in part is due to the efforts of the glass, plastic and aluminum industries to secure a share of market originally held only by the tin and blackplate producers.

Reference to the chart "Containers for Aerosol" show this diversity. Most of these are obviously not suitable for paints but just as the small 1 and 2 ounce glass and aluminum containers have taken over the perfume and cologne industry so may the aluminum can of 22 to 24 ounce sizes secure a large part of the paint business in these "giant" sizes.

In the battle for the market for 22 to 36 ounces paint aerosol cans many factors exist, as relative cost of basic metal, appearance of finished package, shipping weight, as well as corrosion resistance and pressure performance of steel vs. aluminum. To better evaluate these factors and to understand the terms used in describing the cans offered, the attached "Can Glossary" may be helpful.

Aerosol paint cans of today are practically all in tinplate of 6, 12 and 16 ounce size of soldered side seams, and double seamed tops and bottoms. There is also the drawn tin and blackplate can, in 6 and 12 ounce sizes with the seamless body and double seamed bottom.

Giant cans for paint will have to be 22 ounces or larger or "not be worth the effort". To make these of tinplate on the present 211 diameter base they would have to be so tall (8 inches or more) as to be impractical from a can making or filling viewpoint. Diameters of 3 or 3 3/16, which are standard in the can industry, are necessary to make capacities of 22 to 24 ounces at a height of about 6½ inches.

Basic Problems

One of the basic problems is that as the diameter of the base increases the resistance of the ends to buckling under the high aerosol pressures decreases. Ends must stand at least 150 psig. Limitations on double seam quality precludes use of heavier tinplate than about 118 lbs. Likewise as the diameter of the soldered side seam body increases its structural strength decreases. It is in this area of developing satisfactory pressure performances of 300 and

Containers for Aerosols

Tinplate
- 202 Diameter: 3, 6 and 9 ounces
- 211 Diameter: 12, 14 and 16 ounces
- 3 inch Diameter (approx.): 22 and 24 ounces (under development)

Aluminum
- 4 ounces or less
- 6 and 12 ounces
- 22 to 36 ounces (under development)

Glass (Coated and uncoated)
- 4 ounces or less
- 6, 8 ounces and larger (under development)

Plastic (Nylon, Melamine, Delrin [Acetal resin])
- 4 ounces or less

Stainless Steel
- 1 and 2 ounces or less

Welded Steel
- 1 to 2 quart

Photo by Fenten

Twenty-four ounce aluminum aerosol can manufactured by Continental Can Co.

303 diameter cans to which can manufacturers are devoting much time.

As to the drawn black and tinplate container the tooling and technical problems of converting to a deeper draw or larger diameter would appear to preclude the commercial availability of larger cans of this type.

To evaluate the potential for aluminum aerosol paint cans of 22 to 36 ounce capacity, consideration of the relative cost of this metal compared to steel and its structural properties is necessary.

Methods of Fabrication

Production of aluminum cans have been by three basic methods:

(1) Fabricated bodies from sheets using adhesives in the side seam instead of solder. Some tinplate cans have been made by this method for the past 7 or 8 years. It is not practical to solder aluminum. Such cans made with adhered side seams will not withstand much pressure whether of tin or aluminum and appear out of the question for aerosols.

(2) Impact extruded bodies stamped from round thick "slugs". The bottom usually part of body so that can is truly one piece.

(3) Deep drawn or reformed bodies from thick sheets.

Regardless of which method used, the basic cost of aluminum reduced to the equivalent can component is still greater than that of tinplate. However, the differential has been

CAN GLOSSARY

Bake: Operation of removing solvent and curing by heat of an enamel or coating applied to a sheet or container.

Base Box: Standard measure of tinplate area. The area covered by 112 sheets, 14x20 inches, being 31,360 sq. inches or about 217 sq. tf.

Basis Weight: Refers to weight of one base box of tinplate. This is proportionate to the scale of gauges (thickness). Weights commonly used in can manufacturing for aerosols:

U.S.S. Gauge	*Basis Weight*	*Thickness inches (approx.)*
31	95	.0105
30½	100	.0110
29½	112	.0123
29	118	.0130

Black Plate: Low carbon strip or sheet steel not protected from corrosion by tin or other metallic coatings.

Body: Principal part of a container; usually the largest cylindrical portion containing the sides.

Bottom: If separate, double seamed to the body of the can. Usually concave on aerosol cans for strength to resist internal pressure.

Buckle: A distortion of the bottom end at the base of the countersink. Result of internal pressure beyond the structural strength of metal.

Can Sizes: Expressed in inches and fractions (1/16″), overall measurement at double seams, as 211x510, 2 11/16 diameter and 5 10/16 high.

Coatings: Refers to organic, paint or varnish like materials which are applied in thin films to protect interior or exterior of tinplate. Sometimes called enamels.

Compounds (Sealing): A water or solvent emulsion of rubber or other materials used to fill voids in the double seam to obtain a hermetic seal.

Dome Top: Convex top of can in which one inch valve mounting cup is clinched. Top end.

Double Seam: Method of attaching end to can body by which metal plate is interlocked or folded and pressed firmly together. It is produced in two rolling operations, the first of which forms the metal and the second flattens to produce the tight seam.

Drawn Can: Body formed by an operation in which sheet metal or slug changed in shape by flowing or stretching. Often referred to as a seamless can since it has no side seam.

One Inch Opening: Curled top opening of can in which cup or closure, to which valve is attached, is clinched.

Slug: Thick round portion of aluminum from which seamless body is drawn by impact extrusion.

Soldered Seam: Side seam of body of "fabricated can" formed by jointing with solder tinplate into a cylinder. Can made by double seaming on top and bottom to form a three piece can. Present day solder mostly 98% lead and 2% tin.

Tinplate, Electrolytic: Black plate which has been coated on both sides by electro-deposition of tin. Coating weights commercially available contain 0.25, 0.50, 0.75 or 1.00 lbs. of tin per base box of plate. So called tinplate is often less than 1% tin.

Tinplate, Hot-Dipped: Black plate which has been coated on both sides with tin by a process, wherein, after pickling, the sheets are passed successively through flux, molten tin and palm oil. 1.25 and 1.50 lbs. of tin per base box are commercially produced in this type.

Valve Mounting Cup: One inch closure of tinplate or aluminum in which aerosol valve is assembled.

narrowing over the years and it was, in part, this fact of aluminum competition which stiffened the resistance of the steel industry to higher costs in the recent strike.

Aluminum Consumption

The consumption of aluminum by the can industry is expected to increase from about 15,000,000 pounds in 1959 to over 50,000,000 pounds in 1960. This is due to the extended use of aluminum for oil, beer and fruit juice concentrate containers. The use of aluminum for these products reflect somewhat special conditions. Motor oil and juice concentrate (frozen) cans are of "cemented" adhered side seams. Beer cans of aluminum have been produced by impact extrusion. Also, there has been some subsidizing by the large aluminum companies either by direct manufacture themselves or by a controlled plan of scrap reclaiming.

In calculating the relative cost of aluminum it must be recognized that it is of lower density (1/3 that of steel) but that a greater wall thickness (up to 30 to 50%) is required to give equivalent structural strength to tinplate. On some cans as fruit juice concentrate, this equivalent strength may not be necessary whereas for aerosol cans it is imperative.

Cost Comparison

A cost comparison of a container of tinplate vs aluminum would go something like this. Assuming tinplate at 10 cents a pound and sheet aluminum alloy at 45 cents per pound the equivalent can of aluminum with same wall thickness would reflect 15 cents per pound metal. However, compensation for the required heavier wall of aluminum, would result in an equivalent cost of 20 to 22 cents per pound of metal. With the impact extrusion process from aluminum slugs which represent lower costs than deep drawing from sheets the equivalent cost of metal might be brought down to 17 to 18 cents per pound.

To become fully competitive with tinplate cost of slugs would have to be materially reduced. That this may be possible is shown by the fact that one aluminum can aerosol manufacturer is currently offering a one piece can in 6 and 12 ounce sizes roughly competitive with the drawn tinplate cans of the same size. However, costs on both drawn cans reflect higher manufacturing costs than with the three piece tinplate fabricated can. Basically speaking, the spread between steel and aluminum needs to be further reduced before the newer metal can offer much competition in the 6 to 16 oz. can range.

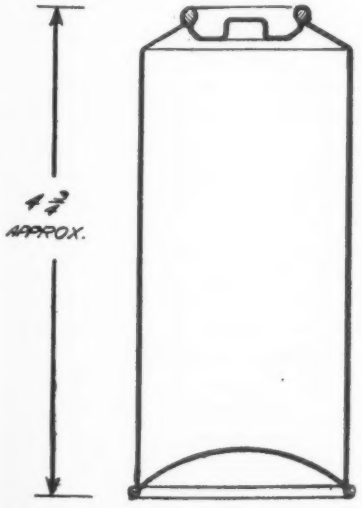
On the small sizes, 4 oz. or less, tinplate is a major disadvantage both from a manufacturing and appearance standpoint. Aluminum has done well on the small containers because its major competition is glass with which it is in a very favored position cost wise.

Likewise, in the 22 to 36 ounce sizes under development, aluminum is in a more favorable position than in the medium size aerosol containers. Drawn aluminum bodies can avoid the side seam strength problem which will plague the soldered side seem design of tinplate. If a tinplate bottom is used with the drawn aluminum body, structural strength can be obtained in the 22 to 24 ounce sizes which will be more difficult with the soldered tinplate side seam. The completely drawn aluminum can in this size would appear to offer the greater structural strength but would need be of heavier aluminum as to make its cost less competitive.

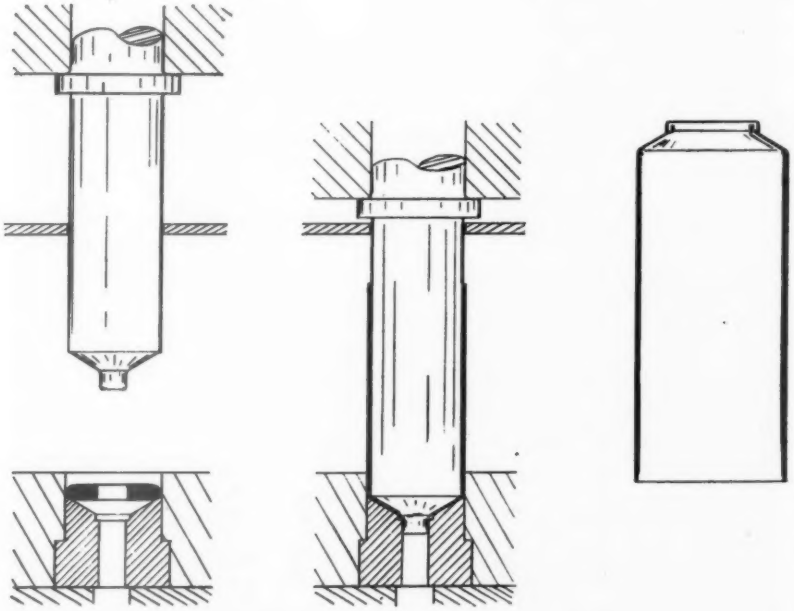
In the quart and larger sized range, aluminum would appear to be without competition except from welded steel containers. Here the problem with both metals is to obtain appearance and sales appeal at a low cost so as to induce mass distribution. The ultimate goal is to have the economy such that it will be preferred by the consumer, costwise, to buy a single 32 oz. rather than two 16 oz. can of aerosol paint for large area coverage.

Corrosion Factor

In evaluating aluminum cans for paint the corrosion factor will have to be fully explored. Generally speaking, aluminum has not been



Cross section of 6 oz. aluminum aerosol can (202 diameter).



Impact extrusion of 6 oz. aluminum aerosol cans.

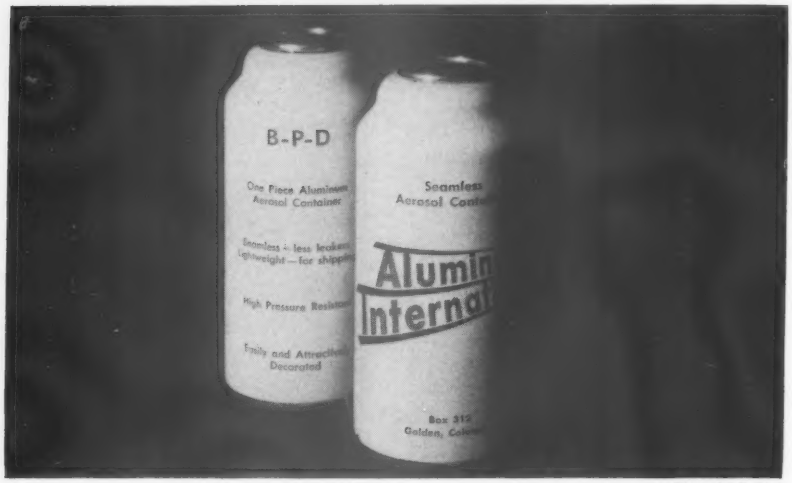


Photo by Fenten

One piece, seamless aluminum aerosol container is high pressure resistant.

as corrosion resistant for most products as tinplate. This has held up wider use of aluminum cans for many products. Aluminum can be coated interior with protective coatings as tinplate. Tinplate is normally coated in the flat before fabrication whereas the drawn aluminum must be coated after forming. With bimetallic containers as aluminum bodies and tinplate bottoms or valve mounting cups, an additional corrosion hazard induced by "galvanic action" may exist. Many of the valve manufacturers are making available cups of aluminum.

This trend towards giant aerosol cans will be followed with intense interest by the paint industry as it is in paints that they find their greatest application.

Rust Inhibitive Paint Packaged in Spray Cans Developed by Benjamin Moore

The introduction of "Retardo" rust inhibitive paint in spray cans marks the most recent addition to Benjamin Moore & Co.'s line of aerosol-packed products.

"Retardo," which has been on the market for some time in conventional type containers, has already achieved an excellent reputation as a fine quality rust inhibitive coating.

The convenience of spray application makes it particularly desirable for touch-up jobs, wrought iron furniture and other metal objects likely to benefit from a rust inhibitive coating.

All kinds of new metal such as iron, steel, aluminum and galvanized iron can be protected against rust by a coat or two of this versatile product. Furthermore, it is equally effective when applied to rusty iron and steel from which loose and scaling rust has been removed. The penetrating and bonding quality of "Retardo" seals the surface so tightly that no air or moisture can make rust active again, the company reports.

"Retardo" reportedly makes an effective undercoat for all types of interior and exterior paint, and is in itself a durable paint coating with excellent weather resistance. It dries hard to an impervious coating that protects metal against rust and corrosion under the most extreme conditions of exposure, including underwater service.

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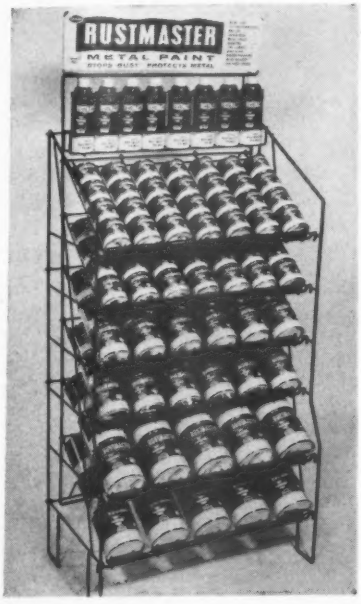
G. Barr and Company Announces Plant Expansion

G. Barr and Co., Chicago, Ill., the nation's largest private label aerosol producer, has expanded manufacturing and warehousing space by 15 per cent, it was reported. The newly leased space is a 15,000 square foot, one-story building adjoining the company's 100,000 square foot building at 3601 South Racine St.

The company has leased an additional 20,000 square feet of outdoor space to enlarge railroad siding and car parking facilities. With the expansion, the firm's plant now extends the full block between South Racine and South May St.

Glidden Introduces New Floor Display Rack

The Glidden Co. has introduced a compact new floor display rack designed to help its dealers in their merchandising of the company's new line of Rustmaster metal protective paints and primers.



Glidden offers the new rack free with the initial assortment of Rustmaster products. These include five popular ready-to-use colors, six intermixes plus black, white and aluminum. Rounding out the line are Rustmaster metal primers, Rustmaster galvanized metal primer, and Rustmaster primer in spray cans.

Rustmaster primer actually penetrates through rust and into pores of bare metal to set up a tightly bound, moisture-free film on and in the surface. Rustmaster protective paints will be aggressively promoted with a large-scale national advertising campaign.

The rack, which is sturdily constructed of heavy gauge steel wire, displays the spray primer at the top with the primer and colors in conventional cans in six levels below.

Slanted shelves keep the display neatly organized and move new cans to the front of the rack as sales are made. The complete display rack occupies a minimum of floor space.

Thus, for a modest investment the retailer may have the complete line of Rustmaster products plus an effective floor display unit.

Rustmaster metal protective paints resist the corrosive effect of weather on exterior surfaces such as window sash and frames, railings, decorative materials, garden furniture, bicycles, toys, garden tools, and playground equipment. It is also effective on interior surfaces such as furnaces, pipes, ducts, and vents.

Midwest Announces New Aerosol Line

Midwest Consultants, Inc., St. Louis, Mo., announces the addition of a second complete aerosol packaging line The new line is a fully automatic straight line 800 series built by The Kartridg Pak Co., Franklin Park, Ill.

Midwest Consultants specialize in filling products which it formulates for private label and name brand marketers.

Organized in 1934, Midwest's plant occupies 240,000 sq. ft. of space on seven acres of ground. Midwest employs over 250 people, including 26 graduate chemists and chemical engineers.

Russian Aerosol Text Available in English

An Army translation of a 460-page compilation and review of Russian literature on aerosols has been released for sale to the public through the Office of Technical Services, Business and Defense Services Administration, U. S. Department of Commerce.

The author, N. A. Fuks of the Academy of Sciences of the U. S. S. R., describes aerosols as a relatively new field of study involving solid and liquid particles suspended in gaseous media. Yet aerosol activity, which ranges in nature from windborne pollen to sea spray, smog and snow, has long been known to scientists. In industry, the aerosol principle has been employed worldwide in everything from explosives to hair spray atomizers.

The book contains a classification, analysis and description of the broad field of aerosols. It relates aerosol activity to such fields as meteorology, botany, soil conservation, bacteriology, nuclear physics, insecticide production, and industrial waste control.

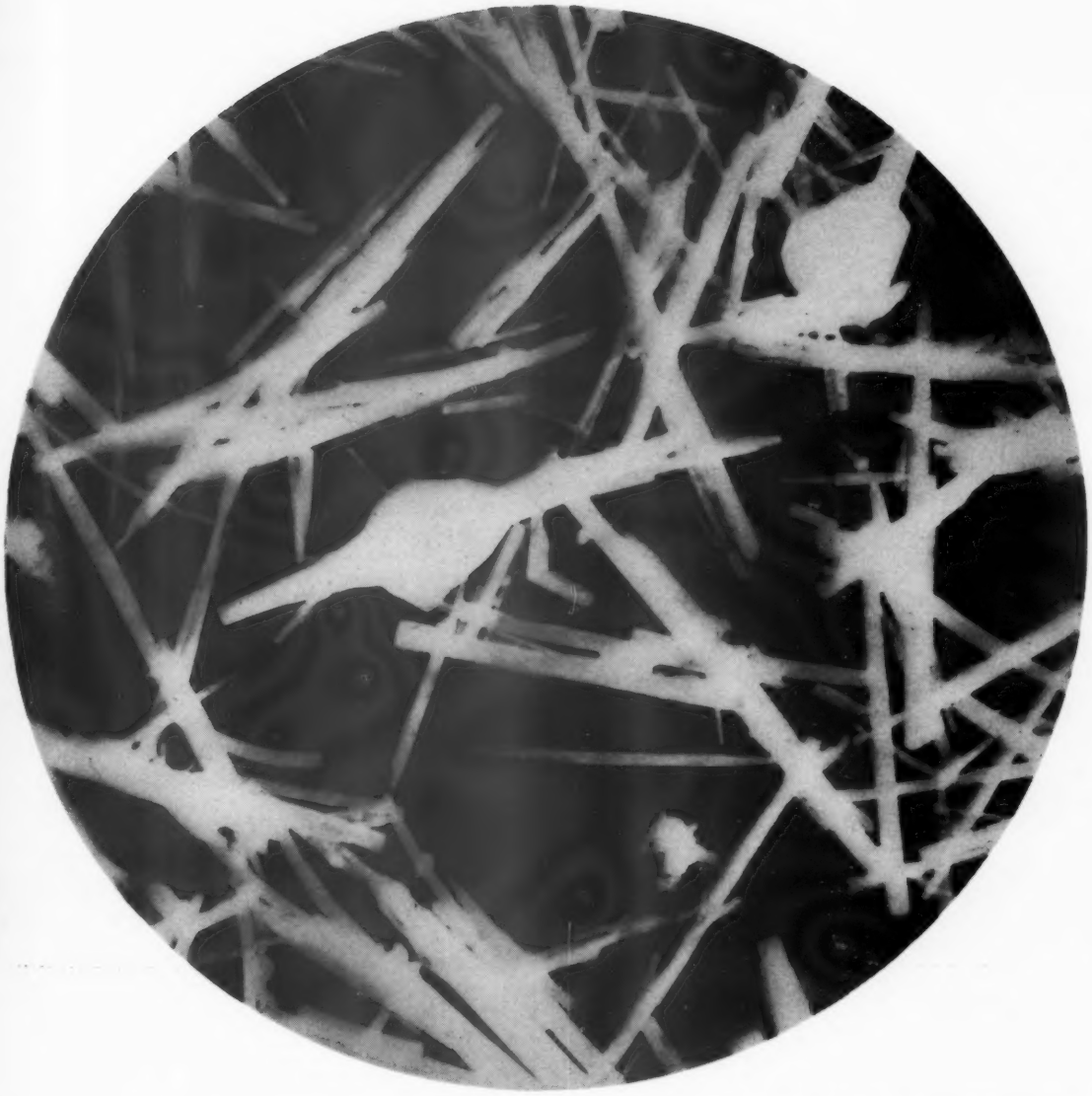
The theories of rectilinear uniform and irregular motion of particles and their variations in dimension are reviewed, and the oscillations of aerosol particles when actuated by sonic waves or pressure and the dispersion and absorption of those waves are highlighted. Also discussed are: the hydrodynamic interaction and electrostatic dispersion of aerosol particles, the curvilinear motion of particles under the influence of gravity as well as different categories of electrical fields, and precipitation and coagulation of aerosol particles during convection and in turbulent currents. Numerous photos, tables and diagrams are included.

The book, 59-21069 *The Mechanics of Aerosols*, N. A. Fuks, Academy of Sciences of the U.S.S.R., 1955, translated by E. Lachowicz, Chemical Warfare Laboratories, U. S. Army, may be ordered from OTS, U. S. Department of Commerce, Washington 25, D. C., price $7.50.

Spra-Lok Corp. Announces New Aerosol Locking Device

Spra-Lok Corp., a wholly-owned subsidiary of Dupli-Color Products Co., Inc., Chicago 16, Ill., announces "Spra-Lok", a mechanical locking device which can be incorporated in all types of aerosol over-caps.

The "Spra-Lok" device prevents accidental or intentional spraying of the contents at the point of sale. A silver foil label covers an opening in each cap where any key may be inserted to unlock the "Spray-Lok" and release the cap. An unbroken seal assures the customer that he is receiving a full measure. If the seal is broken, it indicates the cap has been removed and the contents possibly used. After use, the cap may be placed back on the can in a re-locked position to prevent hazardous or damaging use by children in the home. Subsequently, each time the can is used for spraying, the cap is released by the insertion of a key at hand.



How's this for "BRUSH-HEAP" STRUCTURE?

It's HORSE HEAD XX-602 zinc oxide, magnified 16,000 x. It shows the type of "brush-heap" structure you can build into your exterior house paints to provide *extra body—uniform body—true body.*

The long and thin particles of HORSE HEAD XX-602 zinc oxide offer you the most economical means of controlling consistency in your exterior house paints. We will be glad to furnish a sample for you to prove it by your own test.

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LOS ANGELES

LOW LUSTER PAINT

(*From page 51*)

ceptable ranges for brushing, leveling or viscosity.

Good to excellent blister resistance was obtained with the three basic extenders at 50 to 109% excess binder levels. Paints formulated above 109% excess binder exhibited very poor blister resistance.

In the white control paints ASP 400 demonstrated superior holdout (non-absorption) properties as determined by gloss differences. The superior holdout properties of ASP 400 are further demonstrated by the fact that the calcium carbonate and magnesium silicate paints formulated at the same excess binder level and pigment proportions-(paints 12-29-1, 12-33-1 and 12-33-2) provided less holdout than their control paint counterparts.

Studying three selected extenders, a maximum difference of only 2.7% CPVC was obtained for outside house paint pigmentations containing 59.1% extender of the pigment volume between the following quantities in pounds per gallon for TiO_2 and ZnO.

TiO_2—2.3 to 0.9
ZnO—1.4 to 3.1

A method for comparing extenders at the CPVC and constant prime pigment content has been developed.

Although this study was somewhat cursory, it has served to indicate that CPVC is a criterion upon which house paint formulation may be based, but also indicated is the fact that the extender may be of equal importance in overall paint properties. A more thorough investigation is indicated to substantiate the above results and to evaluate these findings in regard to weathering properties.

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G. A. Menz Dies

George A. Menz, who recently retired as general superintendent of operations for the Sherwin-Williams Co., died suddenly January 4. He was 71, and had marked his fiftieth anniversary with the paint company in October.

Delhi-Taylor Opens New Petrochemicals Terminal

Delhi-Taylor Corp. announced completion of its 2,000,000 gallon petrochemicals marketing terminal at North Charleston, S. C. The new terminal will serve as the distribution center for marketing of toluene, xylene, mineral spirits and high grade solvents to the textile, paint and chemical industries of the southeast.

Delhi-Taylor selected Charleston as the logical site for the terminal because of its geographical and topographical advantages and because of the company's confidence in the industrial growth potential of the southeast. In addition to its central location with respect to the southeastern process industries, Charleston has the advantage of deep water port facilities capable of handling super tankers. The petrochemicals will be shipped by tanker from the company's plant at Corpus Christi, Tex. to the Charleston terminal and distributed to customers by tank car, barge and tank truck.

TRIMETHYLOLPROPANE

(*From page 33*)

as excellent alkali, soap and water resistance, high hardness with excellent impact resistance, excellent color and color retention either on overbake or aging have all come to be associated with this polyol. In highly competitive fields such as automotives and appliances where the usual must give way to the unusual, trimethylolpropane based resins have found a significant and expanding application.

TABLE XI
Enamel Film Evaluation (Short Oil Non-Oxidizing Type Alkyd Resin)

Formulation		VIII-67B
Bake Schedule @ 300°F		10 minutes
Resistance to Overbake		
Gloss	1 Hour	85.0
Color	1 Hour	0.000
Gloss	4 Hours	83.0
Color	4 Hours	0.012
Gloss	8 Hours	81.0
Color	8 Hours	0.017
Water resistance (15½ hours@150°F		Very hard, good adhesion
Resistance to 5% Caustic		Unaffected—67 hours
Soap Resistance (2% Ivory Flakes @ 150°F for 15½ hours)		Unaffected
Flexibility (Zuhr-Conical Mandrel)		No cracks, excellent film
Impact Resistance (Inch-Pound)		Fail 2"
Hardness (Sward)		39

A friend in need

Our technical service is a friend in need to help you solve your problems involving white pigmentation.

In fact, the solution you seek may well be contained in one of our Technical Tips for TITANOX®. We'll be happy to send you, on request, a useful book of these Tips. (And, of course, our local representative is ready to consult with you at any time and to enlist the cooperation of our Technical Service Department). Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities. In Canada: Canadian Titanium Pigments Ltd., Montreal.

TITANIUM PIGMENT CORPORATION

SUBSIDIARY OF NATIONAL LEAD COMPANY

NEWS

NEWS OF COMPANIES, ASSOCIATIONS
TECHNICAL GROUPS
ITEMS OF GENERAL INTEREST

PRESIDENTS of paint manufacturing firms which merged January 1 to form Consolidated Coatings & Chemicals, Inc., were on hand in Kansas City early in January to attend the 50th anniversary sales meeting of the Seidlitz Paint & Varnish Co. Shown between sessions of the two day meeting are G. R. Seidlitz, Seidlitz Paint & Varnish Co. and H. Braith Davis, The H. B. Davis Co. (left and right center). Standing behind them are (left to right): J. Barry York, Masury Paints of Texas, Inc., Houston, Tex.; W. H. Sweney, Jr., W. H. Sweney & Co., St. Paul, Minn., and John R. Seidlitz, Seidlitz Paints of Texas, Houston.

PRESIDENT Raymond C. Adams and Exec. Secretary C. Homer Flynn of the Federation of Societies for Paint Technology addressed a joint meeting of the New England Paint, Varnish and Lacquer Association and the New England Production Club. Mr. Adams explained to an attentive and highly interested audience the workings and aims of the Paint Research Institute and of the Joint Industry Education Committee. He emphasized the good relationship existing between the Association and the Federation and the importance of continued joint efforts of both organizations for the good of the industry.

Seated (left to right): Lee L. Blyler, Pres., N. E. Paint, Varnish & Lacquer Assn.; Raymond C. Adams, Federation Pres.; C. Homer Flynn, Federation Exec. Sec.; James C. Raffi, alternate council representative of the New England Club.

Standing (left to right): James Maroney, Sec.-Treas., NEPVLA; E. A. Monier, Program Chairman, NEPVLA; O. L. Fitz Randolph, Public Relations Director, Godfrey L. Cabot, Inc.; Gregor Berstein, New England Club Pres.; Anthony Yannetti, New England Club Hospitality Committee Chairman and Robert Andrews, Treasurer, New England Club.

Book on Color is Issued

Color. . .And How To Use It is title of new book published by the National Paint Varnish and Lacquer Assn. It was developed by industry color experts for the express use of manufacturers' salesmen, dealers and dealers' clerks. It gives the complete story of color, in capsule form, and will make a better paint salesman of anyone who reads and absorbs its wealth of information, NPVLA advises.

The book is one of the four major Sections of HIDDEN POWER. At only $3 per copy, it is within reach of everyone who wants to know the whys and wherefores of Color, perhaps the most important factor in modern retail merchandising.

Book contains information about the origins of Color. . .what Color actually is. . .how much Color is worth. . .the story of Color through the ages. . .the psychology of Color. . .how Color acts as a stimulant or a sedative. . .the purposes of Color. . .the art of using Color. . .how to sell Color. . .how to decorate with Color. . .the value of Color. . .how you can use Color to satisfy your customers and increase your business. . .and dozens of other facts about Color that will make you a better paint salesman.

Books may be ordered direct from National Paint, Varnish and Lacquer Assn., Inc., 1500 Rhode Island Ave., N. W., Washington 5, D. C.

Fuller to Expand

The Northwest Region of the pioneer paint and glass firm of W.P. Fuller & Co. is being expanded to become the company's northern region, it is announced. The new region will include not only the present states of Washington and Oregon, but also Montana, Idaho, and Utah which were formerly part of the Intermountain Region.

General manager of the new enlarged northern region is Paul G. Loynd, who has been for the past three years general manager of Fuller's intermountain region with headquarters in Salt Lake City. Mr. Loynd will work with the company's corporate survey committee at region headquarters in Seattle in finalizing the consolidation.

NEWS

Food Mach. and Chem. Corp. Enters Epoxy Resin Field

Entry of Food Machinery and Chemical Corporation into the field of epoxy plastics was revealed in an announcement that the company has developed and will introduce a series of unique epoxy resins. The move not only expands FMC's role in the plastics industry, but marks the introduction of a new concept in epoxy materials which is expected to lead to many new applications.

Says Kenneth Wanderer, Manager of FMC's Epoxy Dept., "We believe these new resins will broaden markets for epoxy type materials and eventually lead to a substantial increase in the present 35 million pound market." He estimates that by 1965 the consumption of epoxy resins will reach some 100 million annually.

Known as the OXIRON series, 2000, 2001, 2002, the new materials are vastly different from conventional epoxies in molecular structure, and as a result provide processing advantages as well as several improved end-properties the company reports. They are said to offer potential economies which should make them practical in many cases where, until now, epoxies have been excluded due to high costs. Cost advantages result from the use of higher proportions of relatively low-priced reactants and their lighter weight gives greater volume per pound than conventional epoxy resins.

Paul Wocdnorth

Paul Woodnorth Retires

Paul Woodnorth, veteran chief engineer for the Sherwin-Williams Co., announced his retirement. Succeeding him in the engineering post is Aaron Barkman who has been superintendent of the Chicago paint manufacturing department since 1953. H. W. Smock, who has been superintendent of the Chicago lacquer department, will add direction of the paint department to his present duties.

Mr. Woodnorth joined the company at Chicago in 1944 as a power engineer. He moved into the position of chief engineer in 1950. Prior to joining the paint and chemical firm he had been associated with a number of electric utility organizations.

Mr. Barkman has been with the company since 1935. A chemical engineer, he participated in the development of several of the firm's chemical processes, and was director of the dispersion laboratory before being named assistant chief engineer in 1949. Four years later he was named superintendent of the paint department, the post he is relinquishing to take over direction of engineering.

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NEWS

Cabot to Up Production

Godfrey L. Cabot, Inc., producers of carbon black and chemicals, with headquarters in Boston, Mass., announced that, through a modification and expansion program now being completed at four of its southwestern carbon black plants, it will add 110 million pounds per year to its present production of oil furnace blacks for domestic consumption.

Heyden Newport Building New Tall Oil Plant

Heyden Newport Chemical Corp. has awarded a contract to Foster Wheeler Corp. to build a 24,000 ton per year tall oil refining plant at Oakdale, La.

The new plant, expected to go on stream early in 1961, will be the corporation's second tall oil plant, converting crude tall oil to higher grade products marketed by the corporation's Newport Industries Company division, a leading producer of naval stores. The new plant will augment the production of already existing facilities in Bay Minette, Alabama which have a capacity of 36,000 tons per year.

ROCKETING sales aimed to go beyond all previous records was predicted by the Martin-Senour automotive paint division at its annual sales meeting. William M. Stuart (left), president, and J. R. Degnan, vice president—sales, stand beside rocket which was built in stages as the two-day meeting progressed. Nose cone and pay load for missile represents the potential selling power in each salesman, Degnan told the conference. Guiding fins are Martin-Senour and its exclusive automotive distributing facilities, the National Automotive Parts Assn.

Two new latex formulations, new accent colors, lead-free enamels and a revised line of wood strains and preservatives were among the products unveiled by the trade sales division of Rockcote Paint Co. at its recent annual dealer meeting.

The meeting, which had the largest turn-out to date, brought dealers from nine midwestern and southern states. It was held at the Wagon Wheel Lodge in Rockfon, Ill. and followed by two days of plant tours and technical and sales meetings at the main plant in Rockford, Ill.

Key presentations were made by (left) Byron J. Kluesing, trade sales manager, and (right) John A. Neuman, trade sales merchandising mgr.

NEWS

Laurence L. Kiefer

Laurence L. Kiefer Dies

Laurence L. Kiefer, Executive Vice President of the National Paint, Varnish and Lacquer Assn., Washington, D. C., died of cancer.

Mr. Kiefer became associated with the H. A. Gardner Laboratories of the Institute of Paint and Varnish Research in 1926 which was merged into the National Paint, Varnish and Lacquer Assn. and became the Scientific Section of that organization.

In his staff work for the association, Mr. Kiefer became well known throughout the country as well as in the paint industry. He was one of the formulators of the National Recovery Administration Codes for the paint and allied industries.

In 1934 he became Director of the Trade Sales division of the association, holding that position until 1954 when he was appointed Assistant to the President. He became Executive Vice President in 1959.

He served as Acting Director of the National Clean Up-Paint Up-Fix Up Bureau for several years and visited dozens of cities and received honors in various communities.

Henson Elected Chairman

Walter A. Henson of The Dow Chemical Co., Midland, Mich., has been elected chairman for 1960 of the American Chemical Society's Div. of Paint, Plastics, and Printing Ink Chemistry. He succeeds Dr. Allen L. Alexander, head of the protective coatings branch, Naval Research Laboratory, Washington, D. C.

Chairman-elect is Dr. Edward G. Bobalek of the Case Institute of Technology, Cleveland, Ohio. E. R. Mueller, of the Batelle Memorial Institute, Columbus, Ohio, will be vice-chairman, and George R. Somerville of the Shell Chemical Corp. San Antonio, Tex., is the new secretary-treasurer.

Symposium Planned

The Division of Industrial and Engineering Chemistry of the American Chemical Society is planning a symposium on organic coatings for paper. This symposium will be held at the Fall Meeting in New York City, September 11-16, 1960. Dr. Harold Wittcoff, Director of Chemical Research, General Mills Central Research Laboratories, Minneapolis, Minn., is the chairman of the symposium and should be contacted regarding possible contributions of original research to the symposium.

A 200-word abstract will be required by April 15, 1960, and a complete copy of the manuscript will be required by May 15.

PERSONNEL CHANGES

NEWPORT INDUSTRIES

S. J. Spitz, Jr. has been named executive vice president.

He has been with the firm since 1946, when he joined in an engineering capacity.

MOBAY

Ronald P. Marsh has joined the firm as a technical service representative for Merlon polycarbonate resins.

D. H. LITTER

The following promotions have been announced: **Harold L. Davis** to Executive Vice President and General Manager; **Frank E. Bolway, Jr.,** to Vice President and Sales Manager; **Sidney B. Levinson** to Vice President and Technical Director; **Morris Coffino** to Technical Service Manager.

HEYDEN NEWPORT

Dr. Robert H. Barth has been appointed manager of research responsible for the operation of the firm's Garfield, N. J. laboratories.

Dr. Barth, now research supervisor, has been with the firm since 1938.

BROOKLYN PAINT & VARNISH

Carl L. Engelhardt has been named to the post of Vice President, Research and Development.

Mr. Engelhardt has been with the company for 30 years and has variously been a laboratory chemist, plant manager, industrial sales manager, technical director and now Vice President.

UNITED CARBON

George J. Webster was elected president and general manager of United Carbon France S. A., it was announced.

At the subsidiary's first board meeting **John Bahm,** international sales manager was also made a vice president.

R. W. French, Henri de Roubin, A. G. Treadgold and **H. B. Lawson** were appointed directors of this newly created foreign subsidiary.

The new company will serve France's growing rubber, paint and ink industries as well as export to the rest of the common market.

G. J. Webster

H. L. Wampner

REICHHOLD CHEMICALS

Herbert L. Wampner has been elected to the board of directors, it was announced.

Mr. Wampner, who is the Director of Research, has been with the company 17 years.

Mr. Wampner fills the vacancy on the board resulting from the death of Mr. F. A. Jolles. Mr. Jolles, who was Vice President in charge of Reichhold's International Division, died on January 11.

SUNDURE

Alfred E. Shore has been named Technical Director in Charge of Research, Syracuse, N. Y.

A. Shore

C. C. Clark

SPENCER KELLOGG

Charles C. Clark has been added to the research staff. He will be located at the company's research center on Genesee St. in Cheektowaga, N. Y.

ALLIED CHEMICAL

Anton Viditz-Ward has joined the Technical Service staff. Mr. Ward will operate out of the firm's headquarters at Buffalo, N. Y.

May 13-14. Annual Symposium, Pacific Northwest Paint and Varnish Production Club, Olympic Hotel, Seattle, Wash.

May 19-21. Southwestern Paint Convention of the Dallas and Houston Paint and Varnish Production Clubs, Statler Hilton Hotel, Dallas, Tex.

June 3-4. Annual Joint Meeting of the Kansas City and St. Louis Paint and Varnish Production Clubs, St. Louis, Mo.

PRODUCTION CLUBS

Baltimore, 2nd Friday, Park Plaza Hotel.
Chicago, 1st Monday, Furniture Mart.
C.D.I.C., 2nd Monday.
Cincinnati — Oct., Dec., Mar., May, Hotel Alms.
Dayton — Nov., Feb., April, Suttmilers.
Columbus — Jan., June, Sept., Fort Haves Hotel.
Cleveland, 3rd Friday, Cleveland Engineering & Scientific Center.
Dallas, 1st Thursday after 2nd Monday, Melrose Hotel.
Detroit, 4th Tuesday, Rackham Building.
Golden Gate, 3rd Monday, Sabella's Restaurant, San Francisco.
Houston, Monday prior 2nd Tuesday, Rams Club.
Kansas City, 2nd ThursdaJ, Pickwick Hotel.
Los Angeles, 2nd Wednesday, Scully's Cafe.
Louisville, 3rd Wednesday, Seelbach Hotel.
Montreal, 1st Wednesday, Queen's Hotel.
New England, 3rd Thursday, University Club, Boston.
New York, 1st Thursday, Brass Rail, 100 Park Ave.
North Carolina, 3rd Wednesday, Rainbow Supper Club, High Point.
Northwestern, 1st Friday, St. Paul Town and Country Club.
Pacific Northwest, erd Thursday, Washington Athletic Club, Seattle, Wash.
Philadelphia, 3rd Wednesday, Philadelphia Rifle Club.
Pittsburgh, 1st Monday, Gateway Plaza, Bldg. 2.
Rocky Mountain, 2nd Monday, Republican Club, Denver, Colo.
St. Louis, 3rd Tuesday, Kings-Way Hotel.
Southern, Annual Meetings Only.
Toronto, 3rd Monday, Oak Room, Union Station.
Western New York, 1st Monday, 40-8 Club, Buffalo.

U. S. STONEWARE

Gabriel F. Doria has been appointed Technical Representative. Mr. Doria will work out of the firm's New York City offices.

G. F. Doria

F. Knisley

TAMMS

Fred Knisley, formerly Vice President, Foundry, Flooring and Raw Materials Division, has been named to the new post of Vice President and Treasurer. Mr. Knisley will be responsible for all financial affairs of the company as well as supervision of all accounting, credit, collections and insurance matters.

CLASSIFIED ADVERTISEMENTS

Rates: $.20 per word, except those seeking employment, for which rate is $.10 per word. Minimum: ten words. Address all replies to Box Number, c/o Paint and Varnish Production, 855 Avenue of the Americas, New York 1, New York.

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Distributors wanted in all sections of U. S. for high quality imported white lead (basic lead carbonate). Give details of organization, financial references, territories covered. All replies confidential. Box 460.

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2—3,000 gallon (18,000 lbs. Solid Charge), 7′ diameter by 10′. Stainless with turbine agitator, cooling coils. Reflux tank and condensors each with new never used Selas gas units or one Trent electric jacket. Excellent condition equipment being replaced with larger units by synthetic resin manufacturer. Write Box 3603.

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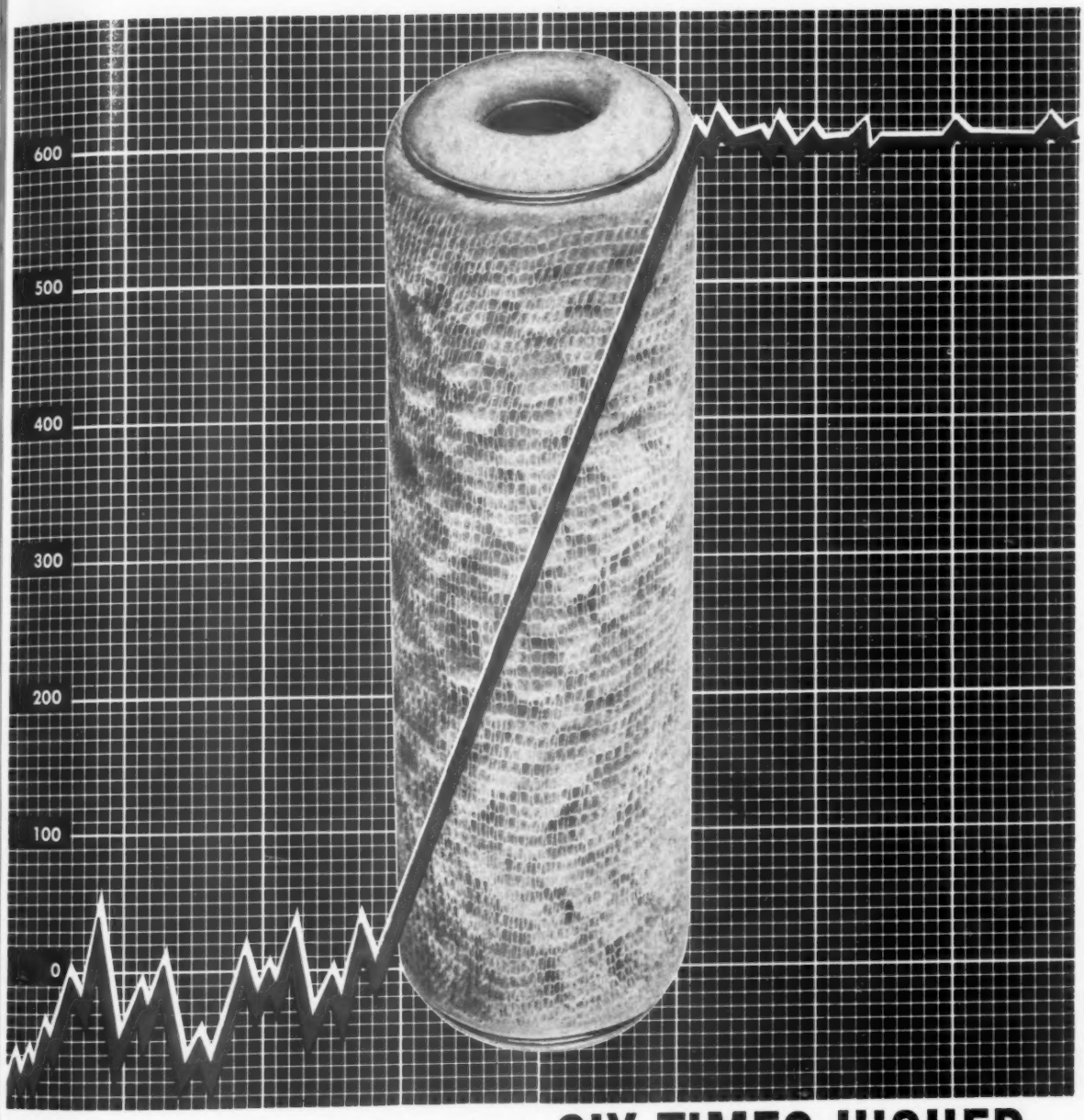

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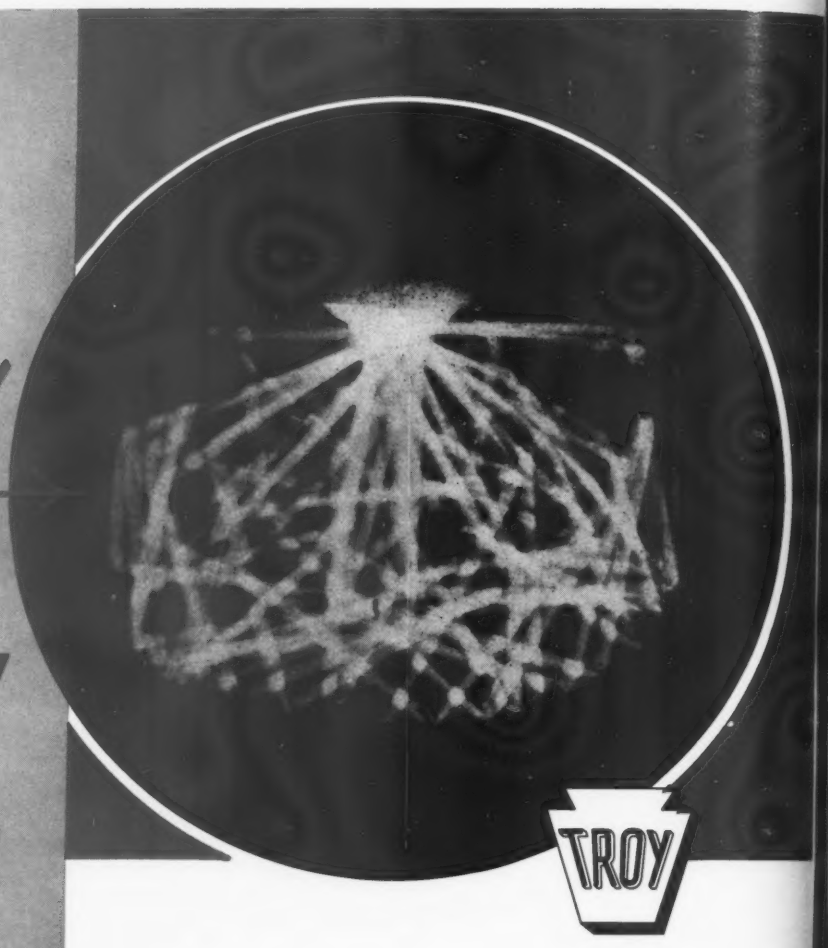

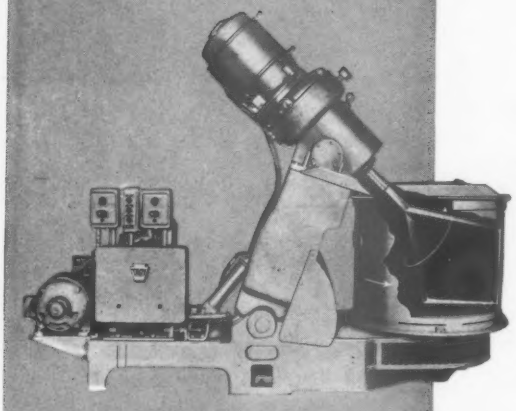

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